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Government
Publications

CANADA.
COMPUTER/COMMUNICATIONS
SECRETARIAT

THE GROWTH OF COMPUTER/
COMMUNICATIONS IN CANADA.

DEC. 1976 —

DEPARTMENT OF COMPUTER SCIENCE
MCLENNAN LABORATORY
UNIVERSITY OF TORONTO

DRAFT FOR DISCUSSION

THE GROWTH OF COMPUTER/COMMUNICATIONS IN CANADA



APR 19 1977

DEPARTMENT OF COMPUTER SCIENCE
MCLENNAN LABORATORY
UNIVERSITY OF TORONTO

Computer/Communications Secretariat
December, 1976

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THE GROWTH OF COMPUTER/COMMUNICATIONS IN CANADA

"When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot express it in numbers, your knowledge is of a meager and unsatisfactory kind: it may be the beginning of knowledge, but you have scarcely, in your thoughts, advanced to the stage of science." ¹

Wm. Thompson, Lord Kelvin

1. SUMMARY

This paper has two principal objectives. The first is to suggest a method of measuring the magnitude of computer/communications spending in Canada on the basis of the partial statistics now published by Statistics Canada, the Canadian Information Processing Society (CIPS), and the federal Treasury Board. The second is to show how this method can be used to integrate the components of forecasts, and therefore improve their consistency.

Since papers on methodology make rather dull reading, it appears desirable to summarize at the outset the estimates derived in the course of developing our techniques. We estimate that the costs incurred by users to obtain the computer/communications goods and services which they required in 1975 totalled about \$2.6 billion. By 1985 these costs will more than triple to some \$8.2 billion. Commercial sales of computing services, which amounted to about 16% of the 1975 total, will grow to almost 22% of the larger 1985 total, by which time they will be about as great as the total sales of computing equipment (including terminals). The most rapid growth will be in spending on telecommunications in connection with computing. This accounted for less than 5% of user costs in 1975, but appears likely to form about 10% of the larger 1985 total.²

Two comparisons with more familiar and better documented totals may help give perspective to these estimates. Computer/communications costs appear to have been equal to about 1.6% of gross national product in 1974. The total revenues of telecommunications carriers³ equalled about 2.1% of GNP in 1974, and commercial transportation contributed 5.0% to GNP.⁴ In 1970 the respective

1. Quoted in Dolotta, T.A. et al., *Data Processing in 1980-1985*, John Wiley and Sons, New York, 1976, p. 87.
2. Our estimates appear in Reference Table X (p. 62).
3. As recorded in *Financial Statistics on Canadian Telecommunication Common Carriers*, 1974 (*Financial Statistics*, 1974), Department of Communications, Tables 1B.1.5 and 2B.1.3.
4. *National Income and Expenditure Accounts*, Vol. 1, Statistics Canada, Cat. 13-531, Tables A3 and GIII.

shares of GNP were about 1.3%, 1.9% and 5.2%. The more rapid growth of computer/communications seems likely to bring it level with telecommunications by 1980, and if current trends continue it may easily be half as great as commercial transportation by 1985.

These forecasts are based on trends visible in publicly available statistics, and on relationships stated in or inferred from those statistics. There is, of course, no guarantee that present trends will continue indefinitely, especially if there were to be a lengthy period of low economic activity or very high inflation. Technological progress is less likely to disturb this sort of forecast, especially within the first five years, than is the existence of some present trend which is not revealed by available statistics.

Early in this project it became clear that it was necessary to define "computer/communications" in a way which would lead to a non-duplicative and comprehensive measure. This report defines "total computer/communications" as the sum of those costs incurred by end users in order to obtain required computer/communications goods and services. This definition focuses attention on the use of computing and related communications, and recognizes that computer/communications is simply a means to serve the varied requirements of its users. It also recognizes that the mix of "computing" and "communications" may shift at any time to adapt to technology and cost changes.

Three supporting activities are recognized as falling within the ambit of computer/communications. These are labelled "computing hardware", "computing services" and "data transmission", and are defined in terms of the revenues which accrue to them, directly or indirectly, as a result of the end user costs referred to above. The paper suggests that other activities which derive revenues from these end user costs do not logically lie within the ambit of computer/communications since only a part (usually a minor part) of their revenues derives from this source. However it is important to recognize the extent to which computer/communications expenditures provide stimulus to these other economic activities.

The concentration on methodology and statistical sources in this paper should not be allowed to obscure the policy implications of the trends apparent

in computer/communications. The growth estimates presented here represent probable Canadian user needs for computer/communications outputs. They should not be interpreted as suggesting that these growing Canadian needs will necessarily be met from Canadian sources or even (as is now the case with computing equipment) through Canadian intermediaries. The extent to which Canadian individuals and enterprises will continue to receive as revenues most of the computer/communications costs incurred by Canadian users will depend on whether Canadian suppliers have put in place the infrastructure necessary to support the larger markets to be expected, and whether Canadian costs are competitive, especially with those of United States suppliers. Government policies can clearly exercise an important influence on developments.

The availability of techniques for estimating the important "unknowns" of computer/communications, and of forecasts against which partial current data can be interpreted, may contribute to the development of private plans and government policies which will ensure the continued healthy growth of computer/communications in Canada and maximize the Canadian share in these activities.

II. A MODEL OF COMPUTER/COMMUNICATIONS IN CANADA

A. The Nature of Computer/Communications

One very useful task accomplished by the Computer/Communications Task Force in 1971 was to develop estimates of the size of computer/communications in the Canadian economy. Their picture of the product and service flows involved, of the employment created, and of the probable growth of computer/communications to 1980 has served as a point of reference for much subsequent discussion and work.¹

The term "computer/communications" has generally been used in Canada in a broad inclusive way, to cover all computing activities plus all electronic data transmission activities. It has not been restricted to those computing activities which actually use telecommunications at any given time; this would miss the point that today any computing activity can be conducted remotely, and that the mix of activities actually conducted remotely is continually shifting with changes in equipment, software and telecommunications facilities and costs. Nor has it been restricted to those activities which enter the marketplace; again the balance is continually shifting between "in house" and "out house" activities.

While it would not be desirable to restrict this inclusiveness, it is necessary to give the term computer/communications clear boundaries if measurement is to be possible. The key to developing an appropriate definition is the recognition that computing and its associated communications are merely a tool through which its users accomplish a variety of purposes. The use of a programmable general-purpose computer is the essential feature of the tool; whether electronic communications are actually used in any particular instance, or even whether the computer is programmed by or for the user, are not essential features. In recognition of this, the terms "computer/communications" and "computing" are used interchangeably in this paper, to include all elements utilized to provide an end user with the computer-based product or service which he requires.

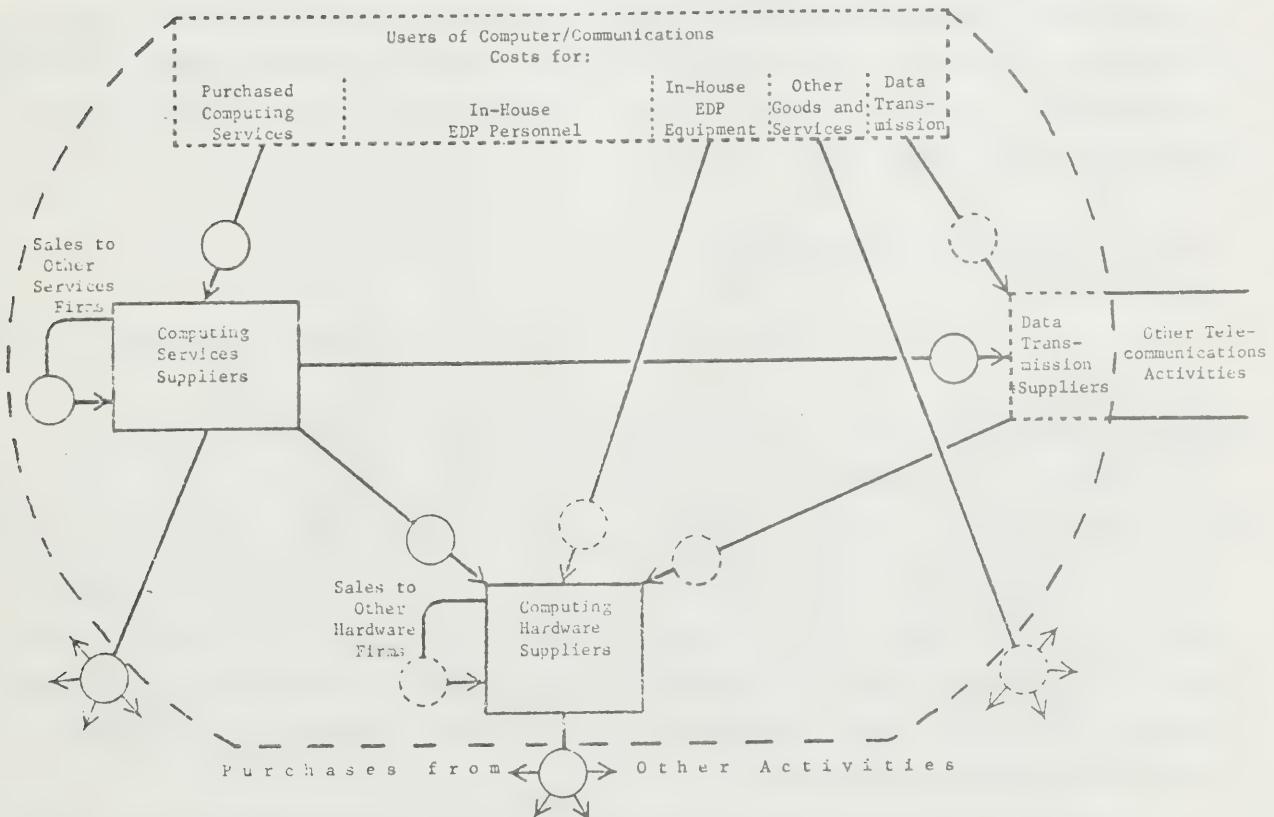
It follows that the total value of computer/communications use in Canada is the total of all costs incurred by end users in order to obtain

1. *Branching Out*, Department of Communications, Ottawa, 1972, especially Ch. IV.

required computing goods and services.. Costs which would be incurred by the user even in the absence of computers are not part of this total. Users who require the services of accountants, engineers, scientists or clerks would require these services whether or not computers were available; use of a computer by such employees does not make them "computer personnel". Computer programmers or operators would not be employed if computers were not used; the cost of these specialists is therefore included in the cost of computing. A similar test can be applied to equipment or to specific telecommunications services; only that which is required or used because of the use of general purpose computers should be included in a measure of computer/communications.²

Starting with this concept of costs incurred by end users in order to obtain required computing goods and services, it is possible to trace the flow of these costs to those who meet the user's needs. Chart I presents a model of computer/communications activities which identifies these flows to other activities and shows the relationships among users and the supporting activities.

Chart I. A MODEL OF COMPUTER/COMMUNICATIONS ACTIVITIES IN CANADA



2. This is the same approach as used by Treasury Board in its Guide on EDP Administration (1974).

The three supporting computer/communications activities shown in the chart are labelled Computing Services Suppliers, Computing Hardware Suppliers and Data Transmission Suppliers. Each of these receives some part of user costs as revenues, and in the first two cases part of the revenues received is spent on purchasing goods and services from other suppliers in the same activity group. In addition, part of the costs incurred by computing services suppliers results in revenues to suppliers of computing hardware and data transmission services, and part of the costs of data transmission suppliers results in revenues to computing hardware suppliers.

In Canada the suppliers of electronic data transmission services are also suppliers of other telecommunications services. These other services such as voice telephone services, telegraph services, and message services via Telex and TWX, lie outside the boundary of the computer/communications field. It is necessary to distinguish the data transmission activities of telecommunications carriers from the other activities of these firms in order to avoid inflating the figures and distorting the trends for this part of computer/communications.

Both users and the defined computer/communications activities procure some goods and services from other activities lying outside the boundary shown for the computer/communications field. Demand stemming from the use of computer/communications usually forms only a small part of the total market of these other activities, and they account for only a small part of computer/communications requirements. It appears inappropriate to include such activities within the computer/communications field.

B. The Availability of Statistics

Since 1971 there has been considerable improvement in the availability of statistical data relating to computer/communications in Canada. Statistics Canada has initiated an annual report entitled "Computer Service Industry" (Cat. 63-222) which presents data for the computing services industry, for the computing equipment industry, and for sales of computing services and equipment by other firms. Steps have also been taken which should lead to the improvement of the EDP-related detail shown in trade statistics. The Treasury Board has started publication of an annual "Review of EDP in the Government of Canada". The basic computer census published by the Canadian Information Processing Society has remained available.³

3. These sources are discussed in Appendix A.

Of these alternative sources, the Statistics Canada report relates most closely to parts of the picture of computer/communications presented in Chart I. The survey on which this report is based, and the format in which its results are published, are based on a statistician's tool known as "industry classification". This tool groups firms for survey purposes on the basis of the products or activities which provide their principal source of revenue. In the case of most industry groups formed on this basis, this principle of classification leads to groupings which account for the overwhelming majority of all production of the goods or services selected to define the principal source of revenue of any group.

In the case of computer/communications, this happy coincidence of industry and activity does not always exist. In the first place, most computer/communications outputs do not enter commerce, but are produced by the end user organization for its own use. Second, three of the largest commercial suppliers of computing services to the Canadian market obtain most of their revenues from the sale of computing hardware or other products,⁴ and a large number of smaller suppliers are outside the "industry" as defined by statisticians. Reliance on industry totals therefore neither throws much light on total user costs nor even provides an adequate picture of total commercial sales of computing services.

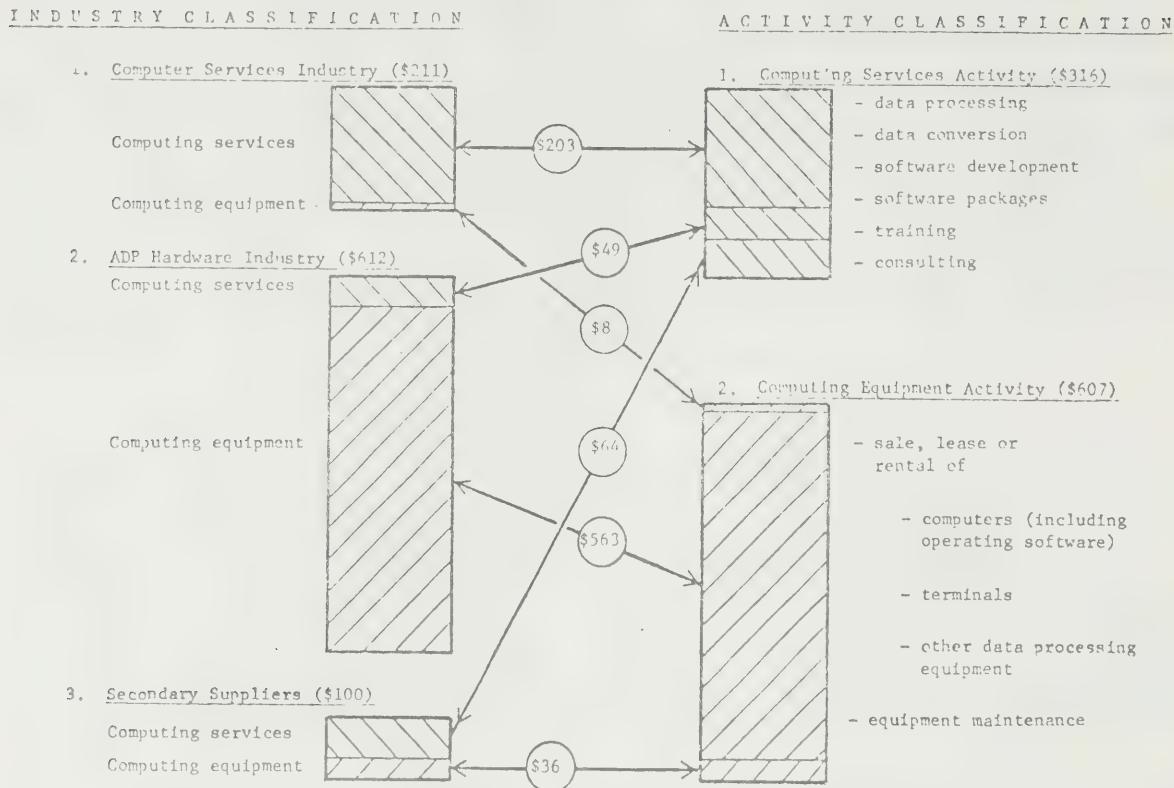
Statistics Canada was aware of these problems when it planned its Computer Service Industry survey. The survey has, from its inception, covered both suppliers of computing services and suppliers of computing hardware, and has provided considerable detail on the "products" from which revenues are earned. In addition, the survey has used a "short form" to collect, from firms in other industry groups, information on the secondary revenues which they earn from the sale of computing "products". This has permitted the figures to be reformatted from an "industry" to an "activity" (or product) basis.

Chart II displays the difference between the "industry" format in which these statistics are collected and published and the "activity" format which is more appropriate for the measurement of computer/communications and the display of relevant trends.⁵ Statistics Canada, for 1974, published statistics for three "industry" groupings: firms whose principal source of revenue is the sale of computer services; firms whose principal source of revenue is the sale, lease or rental of ADP hardware; firms engaged in providing computer services (or equipment) to the public as a secondary activity. In each

4. EDP In-Depth Reports, June, 1976. R.W. Evans Associates, Toronto.

5. See also Reference Table II, (p. 54).

Chart II COMPARISON OF INDUSTRY AND ACTIVITY CLASSIFICATIONS, 1974
(Values in \$'000,000)



of these groups, part of the reported revenue was derived from the sale of computing services (data processing, data conversion, software development, software packages, training, consulting) and part from the sale, lease or rental of computing equipment (computers and their essential operating software, terminals, other data processing equipment, and equipment maintenance).

When the statistics are regrouped on an activity basis, and the activity and industry totals compared, two features are immediately evident. The supply of computing services from the ADP hardware industry is about the same as the supply of computing hardware from the computer services industry and all other industries, and the ADP hardware industry accounts for some 93% of total computing hardware revenues. The supply of computing hardware from the computer services industry is only a fraction of the amount of computing services supplied by either the ADP hardware industry or by all other industries, and the computer services industry accounts for only 64% of commercial computing services.

The relatively low percentage of computing services supplied by the computer services industry reflects the youth of this industry, and the fact that it has not yet fully achieved the competitive advantages in its specialty which are usually found in more mature industries. Only a few years ago, before the withdrawal of RCA, General Electric and Xerox from computer manufacture, the proportion of computing hardware supplied by the ADP hardware industry would also have been appreciably lower than normal.

This contrast between industry and activity totals prevents the use of industry statistics as a proxy for the measure of the computing services market in Canada, and makes the maintenance of adequate activity information critical at least until the computer services field has matured. Unfortunately, the changes in presentation in the Statistics Canada report for 1974 have obscured to some extent this necessary activity information. It was discovered that publication of the sub-activity elements of the ADP hardware industry total for processing and software would contravene the secrecy provisions of the Statistics Act. Statistics for 1974 were therefore published without this detail.

It was possible to estimate the probable size of these elements for 1974 on the basis of data published for 1972 and 1973, when the computer services and ADP hardware industry components were combined. These estimates are shown in Reference Tables I and II. It will become progressively more difficult to make adequate estimates as time goes on, yet such figures are essential to follow trends in the changing market for computing services in Canada.

This problem might be overcome if Statistics Canada found it possible to publish, in future reports, details of operating revenue on a product or activity basis, only showing such additional industry detail as would not contravene the secrecy provisions of the Statistics Act. It might also be worth exploring whether a similar approach should be taken to the publication of class of customer information, though here the need for activity information is less strong and the value of industry information perhaps greater. However, so far as analyses of costs and "principal statistics" are concerned, the industry-based presentation of 1974 has considerably

increased the contribution of these data to the assessment of total computer/communications in Canada.

It might also be generally useful if the totals for "equipment maintenance, education and other" could be subdivided between "equipment maintenance" (usually provided by ADP hardware firms) and "education and other" (which appears to be increasingly a computer services industry product).

C. The Activity Model for 1974

From the statistics which are now available we have derived estimates of the 1974 values represented by the various boxes and circles in Chart I. The values entered in the model or calculated at any step were always rounded to the nearest \$5 million, and percentages used were expressed as full numbers without decimals. As will be apparent, the estimates are of varying reliability, but it is believed that even the more tenuous estimates are adequate indicators of the magnitudes represented.

The following brief description of each step in entering or calculating data for each module of the model is intended to illustrate the relationships among model components and the sources used in each case. At present, these steps can only be followed for 1974, but could be followed in future years as successive Computer Service Industry reports are published by Statistics Canada. Similar steps can, however, be used to extrapolate from more fragmentary current information, as will be illustrated in Part IV.

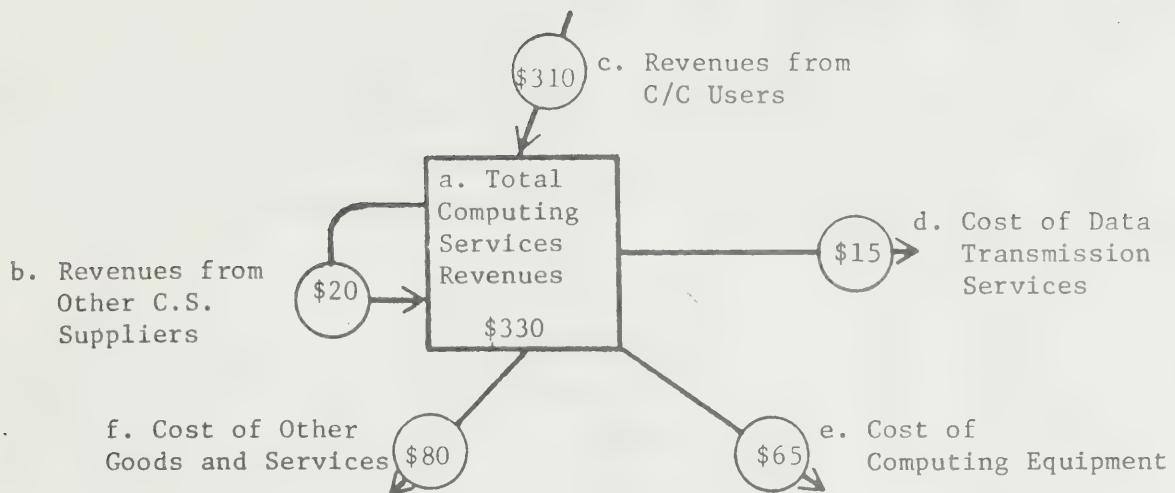
1. The Computing Services Activity

This module, with the relevant values for 1974, is displayed in Chart III. It is firmly based on the Computer Service Industry report; its only major assumptions are the addition of 5% to Total Computing Services Revenues at step a (see below), and the use of industry expense reports⁶ to represent the activity at steps b, d, e, and f. It is therefore, the best starting point for completing the model whenever a new Statistics Canada report becomes available.

6. See Reference Tables VII and VIII (pp. 59-60).

Chart III

THE COMPUTING SERVICES ACTIVITY, 1974
(Values in \$'000,000)



- a. Total Computing Services Revenues: Total operating revenue from sales of computing services as determined from the Computer Service Industry report, plus a 5% addition (which raises the total to \$330 million for 1974). This addition allows for probable shortfalls in survey coverage caused by high birth and death rates among software firms and in the secondary activity group which was confirmed by checking the Statistics Canada survey list.
- b. Revenues from Other Computing Services Suppliers: Operating expenses for purchased computing services are reported to Statistics Canada by firms in the computing services industry. These are published as a percentage of Total Operating Revenues (6% in 1974). This percentage is applied to Total Computing Services Revenues to obtain Revenues from Other Computing Services Suppliers (\$20 million for 1974).
- c. Revenues from Computer/Communications Users: The difference between Total Computing Services Revenues and Revenues from Other Computing Services Suppliers (\$310 million for 1974).
- d. Cost of Data Transmission Services: Operating expenses for communications reported by firms in the computing services industry (4% in 1974, applied to Total Computing Services Revenues: \$15 million).
- e. Cost of Computing Equipment: Operating expenses for equipment reported by firms in the computing services industry (20% in 1974, applied to Total Computing Services Revenues: \$65 million).

f. Cost of Other Goods and Services: Operating expenses for any costs other than personnel, computing equipment, data transmission, and purchased computing services reported by firms in the computing services industry (24% in 1974, applied to Total Computing Services Revenues: \$80 million).

2. The Computer/Communications User Activity

While related to published data, this module is dependent on assumptions as to the cost allocations appropriate for users of computer/communications. These assumptions are based on data reported by Statistics Canada and the federal Treasury Board.

That part of government activities reported on by Treasury Board probably accounts for about 8% of all computing used in Canada, and it cannot be assumed to be a representative sample of users. However the 1974 cost data published by Statistics Canada for computer service industry firms can be compared with the government data, and inferences drawn from the similarities and differences of government and industry patterns. Both sets of data for 1974 (1974-75 for the government) are presented in Reference Tables VII and VIII and summarized below together with the inferred cost distribution for all users.

	Treasury Board %	Statistics Canada %	All Users %
Personnel	45.8	43.8	44.0
Equipment	21.1	20.4	21.0
Purchased			
Computing Services	12.9	6.2	14.0
Data Transmission	2.0	3.9	4.0
Other Costs	<u>18.2</u>	<u>25.7</u>	<u>17.0</u>
	100.0	100.0	100.0

There is no obvious reason why users in general should differ appreciably from government users or specialist services suppliers in their costs for personnel or equipment. In these two cases the all users figure has been estimated as the average of the known figures. It should be recognized that acceptance of the 2:1 ratio of personnel to equipment costs shown by Statistics Canada for the services industry as a whole, and by Treasury Board for a large group of users, is contrary to the traditional view that users spend only about as much

on personnel as on equipment.⁷ A 1:1 ratio may have applied some years ago, but in Canada it does not appear to have survived the trends of the last decade in equipment prices and salaries.

In the other three cases averaging did not seem appropriate. Government EDP operations are, on the average, larger than typical user operations, and are therefore more likely to be able to achieve economies of scale. User operations in general can be expected to acquire a larger proportion of their needs from specialists. The government figure for data transmission is believed to be under-counted because of the difficulty of distinguishing between data and voice costs in telephone billings, and in addition government leased line costs are lower because of bulk buying than those generally available to users. In the "other costs" area, service firms have various promotion costs which would not be incurred by users in general, while government incurs some overhead costs not likely to be characteristic of private users. The "all users" percentages reflect these assumptions (see also Section D.1, pp. 18-19).

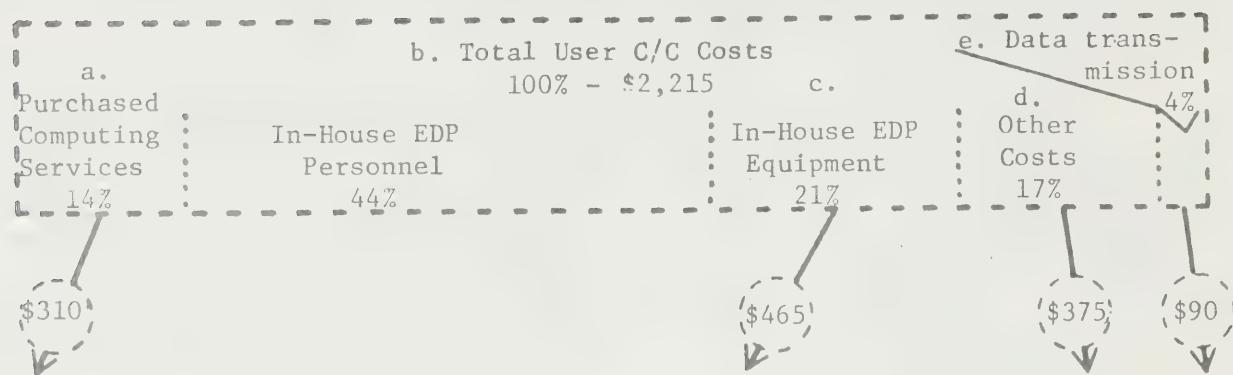
A comprehensive definition of costs lies behind the Treasury Board and Statistics Canada analyses, and is accepted in the assumed user cost percentages. These analyses cover all EDP processes - data conversion, data processing, software, training, equipment maintenance. They cover both purchased and home-made computing. Individual cost statements will depart more or less widely from these averages depending on their completeness and their scale and variety of activities. For example, Statistics Canada reports that in 1974, small computer services firms (mostly software houses) spent only about 12% of their revenues on computing equipment, while the largest computer services firms (mostly service bureaus) used 22% of their revenue for equipment (see Reference Table VII).

Chart IV shows the computer/communications user module of the model, with data based on the cost distribution discussed above. The steps in completing this module were as follows:

- a. Purchased Computing Services: The amount calculated at step c of Section C.1, (p. 11) shown as Revenues from C/C Users in Chart III (\$310 million).
7. cf. 1976 Annual Report, The Computer Services Industry (1976 ADAPSO Report) prepared by the International Data Corporation for the Association of Data Processing Service Organizations (US), especially pages 33, 55.

Chart IV

THE COMPUTER/COMMUNICATIONS USER ACTIVITY, 1974
(Values in \$'000,000)



b. Total User C/C Costs: This figure is based on the premise that purchased computing services formed 14% of Total User C/C Costs in 1974. It is therefore calculated as the amount of which Purchased Computing Services is $\frac{100}{14}$ of \$310 million = \$2,215 million for 1974). This is the most critical step in completing the model because it transforms a small figure into a large one which in turn determines the size of the other elements of this module.

c. In-House EDP Equipment: Calculated as 21% (for 1974) of Total User C/C Costs (\$465 million).

d. Other Costs: Calculated as 17% (for 1974) of Total User C/C Costs. (\$375 million).

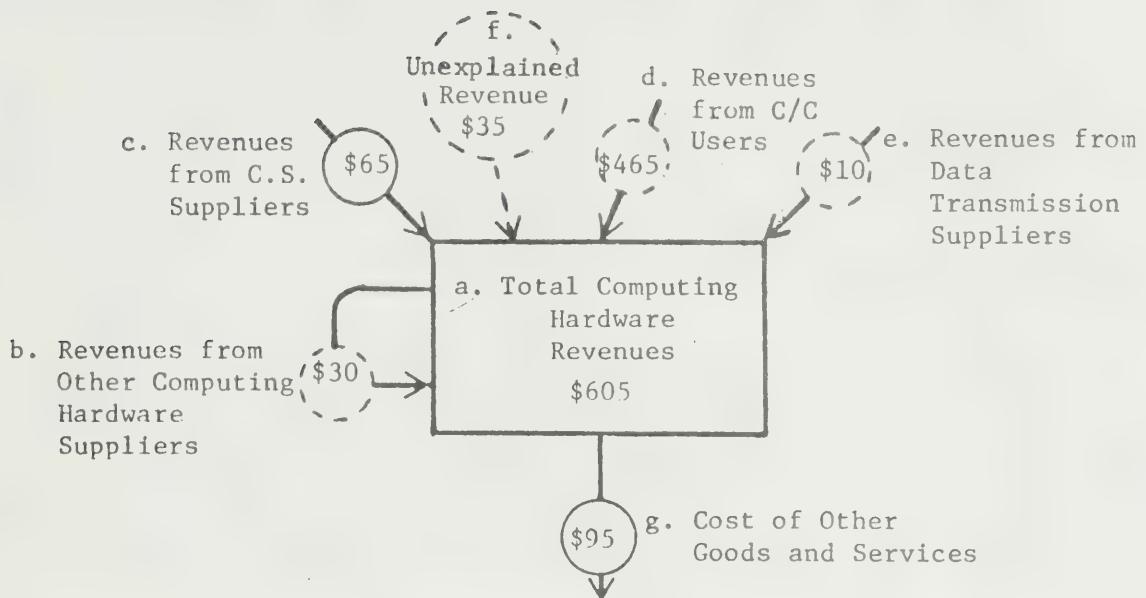
e. Data Transmission Costs: Calculated as 4% (for 1974) of Total User C/C Costs (\$90 million).

3. The Computing Hardware Activity

This module is based on total operating revenues from all sale, lease or servicing of ADP hardware reported by Statistics Canada. A check of the Statistics Canada survey lists indicated no significant gaps in coverage, so no addition has been made to the total except for our estimate of maintenance revenues. The information available on the sources of revenue by class of customer is not sufficiently detailed to match the activity concepts of this model, and customer classification may be somewhat imprecise since it is respondent-reported. The main problem, then, was to quantify the inflows. This module is presented in Chart V. The steps in its completion were as follows:

Chart V

THE COMPUTING HARDWARE ACTIVITY, 1974
(Values in \$'000,000)



- a. Total Computing Hardware Revenues: The activity total based on the Statistics Canada report (\$605 million for 1974). Survey coverage is believed to be quite good, and the total reported for 1974 has a reasonable relation to the estimated value of all computer configurations reported by CIPS.
- b. Revenues from Other Computing Hardware Suppliers: Assumed to be 5% of Total Computing Hardware Revenues in 1974 (\$30 million). There is no statistical basis for this assumption, but it appears reasonable in the light of what is known about hardware production and marketing, and of discussions with some suppliers.
- c. Revenues from Computing Services Suppliers: Shown as the cost calculated at step e of Section C.1 (\$65 million in 1974).
- d. Revenues from C/C Users: Shown as the cost calculated at step c of Section C.2 (\$465 million in 1974).
- e. Revenues from Data Transmission Suppliers: Assumed to be a nominal \$10 million in 1974; there is no statistical basis for this assumption, nor even enough general knowledge of this flow to determine whether this figure is reasonable,
- f. Unexplained Revenue: The amount by which a. exceeds the sum of b + c + d + e (\$35 million in 1974). This amount must be satisfactorily explained or eliminated in order to "close" the model.

It is believed that the explanation lies in the fact that the cost data initially entered at steps c and d differ in concept from revenues as reported by equipment suppliers; i.e. that the \$35 million of unexplained revenue can reasonably be attributed to the excess of computing hardware supplier revenues from equipment sold in 1974 over the amount of depreciation recorded in the same year by in-house and computing services firms who own equipment.⁸ This amount is therefore labelled "Revenue/Cost Surplus" in Chart VI, and shown as an addition to the user and computing services flows to computing equipment revenues.

g. Cost of Other Goods and Services: Operating expenses for any costs other than personnel, computing equipment, data transmission and purchased computing services reported by firms in the ADP hardware industry (16% in 1974, applied to Total Computing Hardware Revenues: \$95 million).

4. The Data Transmission Activity

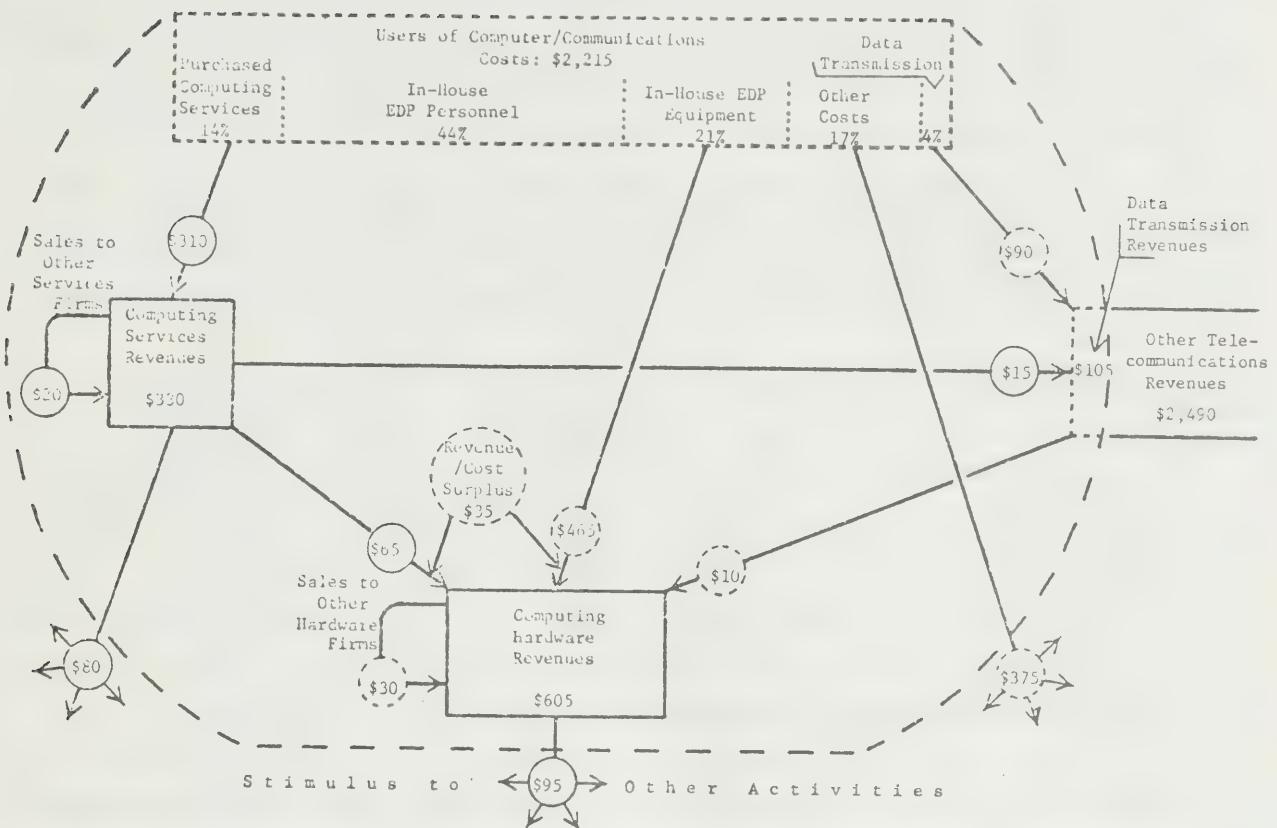
This module is entirely derived from the preceding calculations. It is the sum of identified computing services expenditure on data transmission (step d of Section C.1 - \$15 million) and identified user expenditure on data transmission (step e of Section C.2 - \$90 million). This completes the calculations for the 1974 model; the results are displayed in Chart VI.

8. Statistics Canada reported that 61% of the hardware activity revenues of the ADP hardware industry in 1974 came from equipment rentals, maintenance and similar items which would be treated as current expenses in the cost records of those from whom this revenue was received. The remaining 39% (\$222 million) came from sales of equipment, most of which would be capitalized in the accounts of the purchaser, and included in costs on the basis of depreciation charges (probably of the order of 15%-20% of capital cost). In other words, of the seller's revenue of \$222 million, only \$40 million would be included in the first year costs reported by users.

Most of the difference of \$182 million (\$222 - \$40) will be offset by user accounting for depreciation on equipment purchased in earlier years (and there will be no corresponding current sales revenues to manufacturers). However since equipment sales have been increasing sharply over the past several years, the amount of depreciation on past year purchases is unlikely to come close to the amount of current year purchases not charged to depreciation. The \$35 million of unexplained revenue is of the order of the remaining difference that could be expected; it implies that depreciation on past year purchases totalled about \$142 million in 1974 (\$177 - \$142 = \$35).

Chart VI

COMPUTER/COMMUNICATIONS IN CANADA, 1974
(Values in: \$'000,000)



The use of a derived figure for data transmission based on user perceptions of their costs for these services involves a quite different concept from that used by the Task Force. To date, data transmission suppliers have tended to lump data transmission with all other non-voice services (telegraph, telex, TWX, etc.) in a general category usually referred to as "data communications", and this concept was also used in Branching Out. Carrier revenues from data communications, defined in this way, include both revenues from the provision of services which are not computer-related, and considerable revenues from the provision of terminals to some customers.

Both the Statistics Canada and the Treasury Board cost analyses treat terminals as computing equipment, and report their cost as an equipment cost, not as a data transmission cost. It follows that data transmission, as defined in this model, includes only the actual movement of computer-related data from originating to receiving point (including any "communications processing" involved in this such as formatting or error checking by the carriers). It does not include terminal costs (these are generally included in the computing hardware activity module) nor any services relating to data which are not computer-related (these are excluded altogether). These are the principal reasons that data transmission

revenues, as identified for 1974, are lower than the data communications estimate for 1970 presented by the Task Force.

The estimate of \$105 million in data transmission revenues can be compared with the Department of Communications' estimate of \$2.6 billion for total operating revenues of telecommunications carriers in 1974.⁹ It is 4% of the larger total. Even with terminal revenues added it would probably be only about 6% of this total. As will be seen in Part IV, it is the most rapidly growing element of computer/communications.

5. Stimulus to Other Activities

The model shows flows totalling \$550 million in 1974 which represent the purchase of goods and services from activities which lie beyond the boundaries of computer/communications. Reference Table VII gives an indication of the variety of these costs. There would be some further stimulus from data transmission suppliers, but present statistics provide no basis for estimating its size, and it has therefore been omitted.

The wages, salaries and benefits paid to personnel employed in computer/communications activities also provide a stimulus to other economic activities. Again excluding data transmission, these personnel costs totalled about \$1.3 billion in 1974 (see Reference Table X). Almost 57% of user costs for computer/communications are accounted for by the personnel costs of users, computing services suppliers and computing hardware suppliers.

D. Validation Checks

1. Internal Consistency

The 1974 model provides a measure of self-validation through the independent entry of totals for computing services revenues and computing hardware revenues which must both be consistent with the other elements displayed. It is possible to achieve this consistency with alternative sets of assumptions. Consideration of some of the alternatives explored will indicate additional reasons for preferring the estimates in Section C.

9. Financial Statistics 1974, op. cit., pp. 29, 153.

The most critical point in the calculations is where the relatively good figure for computing services revenues from computer/communications users becomes the basis for the much larger estimate of total computer/communications user costs.

Alternate estimates of the percentage of user costs accounted for by computing services were tested (holding the computing equipment and data communications percentages constant) with the following results:

Computing Services % of User Costs	Total User Costs	Revenue/Cost Surplus \$'000,000	Data Transmission Revenues
%			
12	2,585	-45	120
14	2,215	35	105
16	1,940	95	95
18	1,720	140	85

There have been suggestions by some data transmission suppliers that an estimate of \$100 million for data transmission revenues (as defined in the model) may be on the low side. Estimates of the likely Revenue/Cost surplus from CIPS data range from \$35 million to \$100 million depending on assumed depreciation periods and interest rates. Doubts have been expressed by some computing services suppliers as to whether purchased services account for as much as 14% of user computer/communications costs. The 14% figure used seems to be less inconsistent with these conflicting observations than would 15% or 16%. Figures as low as 12% or as high as 18% are clearly inconsistent with the other assumptions regarding user cost and equipment revenue distribution.

The same range of percentages was also tested using somewhat lower estimates for personnel costs (40%) and somewhat higher estimates for equipment costs (25%). It requires an assumed 17%-18% for computing services to obtain a reasonable estimate for the Revenue/Cost Surplus, and at this level the figure for data transmission appears much too low.

A higher data transmission cost percentage for users than for computing services firms would resolve some (but not all) of the difficulties with alternative estimates of user costs. However a higher user percentage seems unlikely, and United States studies suggest that data transmission more likely accounts for a lower proportion of user budgets than of computer services industry costs.¹⁰

2. External Comparisons

Only a limited number of external checks is possible, given the scarcity of existing data, and these largely depend on inferred likely relationships. Four of the checks made are briefly described below:

- (a) User Costs: Total federal government EDP costs were reported by Treasury Board as \$208 million in 1974-75. This is 9.4% of estimated user costs, a greater percentage than the 6.3% of the hardware industry market shown by Statistics Canada as accounted for by the federal government in 1974, or even than the 8.2% of the computer services industry market accounted for by the federal government. CIPS data also suggest that the federal government may account for about 8% of computer use. Federal government EDP may incur or record some costs not incurred by most other users, or omissions from the computing service revenues reported in the 1974 Statistics Canada survey may be greater than believed, and the true value of user costs therefore greater than indicated.
- (b) Computing Services Revenues: R.W. Evans Associates reports¹¹ that twenty-nine leading firms had computer services revenues totalling about \$163 million for fiscal years ending in 1974. Statistics Canada reported a total of 345 computing services industry establishments in 1974, and indicated about the same number of secondary suppliers. This suggests average revenues of less than \$250,000 for the more than 600 firms not covered in the Evans report, a not unreasonable figure since Evans has almost certainly identified all firms with revenues as great as \$1 million.
- (c) Data Communications Revenues: A recent study by the Department of Communications suggests that carrier revenues from data communications were about \$200 million in 1974, excluding Telex revenues.¹² The model identifies only \$105 million. The difference between these two figures would be accounted for in part by conventional message transmission revenues (other than Telex) which the telecommunications industry groups with data communications. In part it would likely be accounted for by rentals of terminals and other data communications equipment. The possibility that the cost data on which the model is based do not report communications costs fully must also be recognized.¹³
- (d) Computing Hardware Revenues: The annual rental value of the equipment reported in the CIPS Census for 1974 (plus an allowance for minicomputers) is estimated at \$550 million (see Reference Table III). Treasury Board has reported that about 90% of the reported cost of all in-house EDP equipment in 1971 and 1973 was accounted for by computer configurations.¹⁴ This suggests total equipment revenues of about \$605 million for 1974 (not allowing for any undercounting in the CIPS census, nor for the difference between revenues and costs which was discussed above).

11. op. cit., and telephone discussion.

12. Pallavicini, S.: The Characteristics of Data Communications Tariffs. Department of Communications, June 1976, pp. 4-6.

13. But cf. 1976 ADAPSO Report. op. cit., pp. 33, 55, which suggests 4.5% for large users (on the basis of direct EDP costs), and 7% for "processing type companies" (including communications hardware).

14. Review of EDP in the Government of Canada, 1974, p. 16.

In general, these tests suggest that the Statistics Canada-based model may be yielding rather conservative totals. Even the data transmission discrepancy, however, does not demonstrate that the degree of error is likely to be substantial. The relationships developed in this model were therefore used, with other source data, to develop estimates for 1970, 1975, 1980 and 1985.

E. Gaps in Statistics

A major gap in existing statistics, as illustrated by the model's construction and checking, is the lack of any benchmark for total user spending on computer/communications services. Because user spending is largely for in-house services, and because computer/communications use is penetrating most industries today, there appears to be little chance of obtaining this sort of benchmark. Even if Statistics Canada attempted to ask all industries about "cost of all computer/communications services used", it would be almost impossible to ensure conceptually consistent replies. It seems likely that for some time the sort of inference from computing services revenues or computing equipment revenues, which is illustrated by the model, will have to serve.

It might be more practical - and almost equally useful - to develop a sample study of the nature of user costs for computer/communications, along the lines of the profile for computer service firm costs contained in the present Computer Service Industry report. Such a survey - even if only periodically available - could be linked to data in both the Computer Service Industry report and the Review of EDP in the Government of Canada.

Another lack is of statistics about data transmission revenues and their disposition. This gap will be difficult to fill because of the differences of opinion as to the boundaries of data transmission activities, and the proper limits of the regulated telecommunications industry. However it is a small part of the picture for 1974.

III. THE DIRECTION OF CHANGE

A. Available Indicators

Some of the data on which the model in the preceding section is based are available only for 1974, and even for that year one element had to be estimated. Time series of sufficient length to permit an assessment of trends can be obtained only from the CIPS computer census (available from 1965 on an essentially comparable basis), and from the Treasury Board's Review of EDP in the Government of Canada (many key series estimated from 1967-68).

As between these two sources, the CIPS Census is likely the better indicator of the overall growth of computer/communications. It relates to all users of computing, and to all uses. Both first hand experience and comparisons between CIPS and Treasury Board data suggest that at some times the growth of computing in the federal government has been more rapid than in most other application areas, and that this growth has at other times been reduced below average by temporary financial limitations or administrative policy changes. The CIPS data were therefore used to establish patterns of change which were extrapolated as a basis for more detailed forecasting.

Trend extrapolation is subject to two principal sources of error. First, existing trends may be improperly identified. Second, the wrong pattern may be chosen to indicate future developments. Substantial departures from any forecast are probable, not just possible, especially in a field like computer/communications which is both new and changing rapidly. The value of a forecast is in drawing attention to the need to review judgments and policies determined in the past, sometimes on the basis of assumptions that have been disproven by events.

B. Basic Assumptions¹

1. Technology

The forecast assumes that only presently known computing and communications technology is likely to come into widespread use within the next decade. There

1. See T.A. Dolotta et al., op. cit., for a much more detailed discussion of likely developments.

will be continued steady improvements in central processors, storage media, peripherals, and communications equipment and techniques, but no radical changes which will completely obsolete existing equipment and methods of use.

If a revolutionary change in technology, or even in engineering, is developed during this period, it will almost certainly require several years to bring into widespread use. As the inventory of equipment and programs in use expands, barriers are created to sudden change by the volume and variety of investment that would be required, and by shortages of the trained personnel usually needed to implement the change. It seems unlikely that technology could significantly alter present anticipations until 1980, and perhaps not even before 1985.

The microcomputer is one item of existing technology which is not expected to have revolutionary effects on computer/communications as defined in this paper. The microcomputer is expected to widen the range of applications of computing in the next decade, rather than to replace large computers in most present and many potential uses (although its technology will help reduce their size and cost). An area in which there may be a measure of displacement is industrial process control, another is automated data collection. Even in these areas, however, complete displacement of larger and more versatile equipment seems remote.

One effect of the microcomputer will be to obsolete efforts to count all devices "capable of accepting, processing and supplying data under the control of an internally-stored program which it has the ability to modify".² A distinction will have to be made between general purpose machines with a wide range of capabilities and which can be adapted to alternative tasks by most users, and special purpose devices suitable for a specific or a limited range of applications by most users. A forecast or analysis of microcomputer use is beyond the scope of this paper; microcomputers are not included in the present data base and seem unlikely to be includable in any similar future base.

A second effect of the microcomputer will probably be to "flatten" the growth of conventional computers (including minicomputers) somewhat earlier than might otherwise have been the case. They will provide an alternative to computing for some office, analytical and scientific tasks where conventional computers have not really been cost effective.

2. Costs and Prices

The unit cost of data transmission seems likely to show a moderate decline over the next decade. It costs today probably about half as much to transmit a "typical" volume of data as would have been the case ten years ago (there are wide variations depending on the speed and service utilized). A further decline of about the same magnitude by 1985 would appear to be a reasonable expectation (again, varying with speed and service).

The cost of computing equipment has been declining much more rapidly throughout the computing age. The rate of decline has not been the same for all configuration components, but in general the equipment cost of performing a "representative sample of work" has probably fallen by about an order of magnitude each decade. Put another way, a typical computer configuration costing \$100,000 in annual rental in 1975 would probably be able to perform ten times the work of a typical configuration which cost the same amount in 1965. Thus the increase in annual rental value of installed capacity between 1965 and 1975 (about 8.7 times) does not reflect the increase in installed computing capacity. The actual capacity increase in the period was probably of the order of 80-90 times the 1965 figure.

The same order of decline in configuration costs is assumed for 1975-1985, and the same relationship between the increase in the value of installed capacity and its capacity to perform work. This relationship must always be kept in mind when using value time series and forecasts relating to computer/communications; value increases often reveal only a fraction of the underlying increase in service volume.

Because the price trends for major computing components differ so radically from the general trend of prices in Canada, no attempt is made in this forecast to reduce values to "constant dollars". Relationships between computing and other economic activities expressed in constant dollars would be radically different from the same relationships expressed in current dollars. This would make it difficult to use forecasts as guides to the interpretation of current data. In addition, because of the steady increase in the variety of computing applications, the concept of a "representative sample of work" would have only limited validity even over a period as short as a decade. The data from which trends have been appraised have been left in their original

current dollar form; the trends established include whatever price changes have taken place in the base periods. Price change of about the same magnitude as in the past decade is therefore assumed throughout the forecast.³

3. Market Expansion

Computer/communications has so often been described as "pervasive" that the adjective has almost lost its impact. Yet this adjective came into widespread use when computing activities were much more restricted than is the case today, both in their variety of applications and in the number of firms that could economically access this tool.

The growth both in the variety of applications of general purpose computers and in the range of size of firms which use computers to perform any application (users with different volumes of data to process) is expected to continue over the next decade. The pervasiveness of computers will increase as the cost of computing falls. As the number of smaller users increases, the share of the market of both small computers and service bureau operations should increase, that of middle-sized in-house computers should decrease. Even here, however, a continued growth in absolute numbers seems likely; the decline will be only as a share of a rapidly growing total.

Although most computing "products" will show considerable growth in use, some will grow much more rapidly than others. Local batch computing is likely to grow less than remote batch, remote batch less than on-line transaction applications. The growth of special input preparation operations is likely to be slower than that of any type of processing, as input preparation increasingly becomes a minor aspect of some non-computing task; it is not impossible that input preparation work which falls within the computer/communications area will actually start to decline before 1985. Software, especially software packages, seem likely to be the fastest growing product range. These trends can all be identified in data published by the Treasury Board and by Statistics Canada.

3. In taking this approach we differ from Dolotta et al, op. cit.

Many observers expect to see a trend towards the provision of complete service packages - software, hardware and necessary ancillary operations - by vendors of computing services. These may take the form of delivery of a complete processing system for subsequent in-house operation, or the provision of a complete functional service such as payroll preparation and analysis. Such a trend is assumed in this paper, but cannot be demonstrated from existing statistics.

Text processing, including the preparation, transmission and storage of written information by electronic means (electronic mail), may be one of the faster growing computer/communications services by 1985, if the specific data transmission services which it requires are cost effective. Large scale integrated systems, such as the electronic funds transfer system, should also have a major impact on the growth of hardware, services and data communications revenues. Neither of these developments can be demonstrated from existing statistics.

C. The Increase in Computer Installations

The relatively low number of computers recorded by the 1965 CIPS Census, and the small number of computers installed in the federal government reported by the Glassco Commission for 1961⁴ both testify to the slow growth of computing in Canada from 1950 to 1965. The growth in the number of computer installations accelerated sharply after 1965. However between 1970 and 1975 fewer computers were added to three of the annual rental groupings identified in the CIPS Census (those with annual rentals between \$60,000 and \$600,000 - see Reference Table III) than had been added between 1965 and 1970.⁵

The visible differences in growth patterns for computers of different sizes, and the similarities among size groupings, suggested that a degree of consolidation would simplify analysis and forecasting without increasing the probability of error. After some experimentation, the seven value ranges shown in the CIPS census were reduced to four. The compound growth rates for the number of computers in each group are as follows:

4. Report of the Royal Commission on Government Organization, Queen's Printer, Ottawa 1965. Vol. I, Report 4, Part II, Ch. 8, pp. 584-589.

5. The CIPS Census presents data in terms of monthly rental equivalent. This paper uses annual rental equivalent to facilitate comparisons with other totals.

<u>Annual Rental Value Group</u>	<u>Compound Growth</u>	
	<u>1965-70</u>	<u>1970-75</u>
	%	%
\$600,000 and up	95	22
\$60,000-\$599,999	26	5
\$12,000-\$59,999)	(27
under \$12,000)	(63

These figures suggest that the growth in the number of computer installations in each group is following the sort of "S-shaped" curve often associated with the introduction of a new technology. The time scale is, however, quite compressed compared to such innovations as the automobile. The slow growth period while the new technology was debugged and potential users became aware of its possible value lasted no longer than 15 years. The period of rapid growth until market saturation was approached seems to have been passed by some computer groupings in less than ten years. It must not be forgotten, however, that the growth in the use of computing is an order of magnitude greater in any decade than the growth in the number of computers of any size, or in the total value of installations.

A forecast of the number of installations in each group was made by fitting a freehand "S" curve to available data. The estimated number of installations was then expressed in terms of estimated annual rental value (for each group existing trends in average rental value of computers in the group were continued). The estimates of number are shown in Chart VII; both number and value estimates appear in Reference Table V.

These estimates were compared with estimates based on exponential curve fitting (constant percentage rates of increase) and linear regression. The use of exponential curves is difficult to justify in the light of the compound growth rates cited above, and the estimates resulting from such curves seem unrealistically high. Estimates based on exponentials also appear to perpetuate the present computer distribution to a greater degree than seems reasonable. This latter fault is even more apparent in figures produced by linear regression, although the total numbers produced by this technique appear less unreasonable.

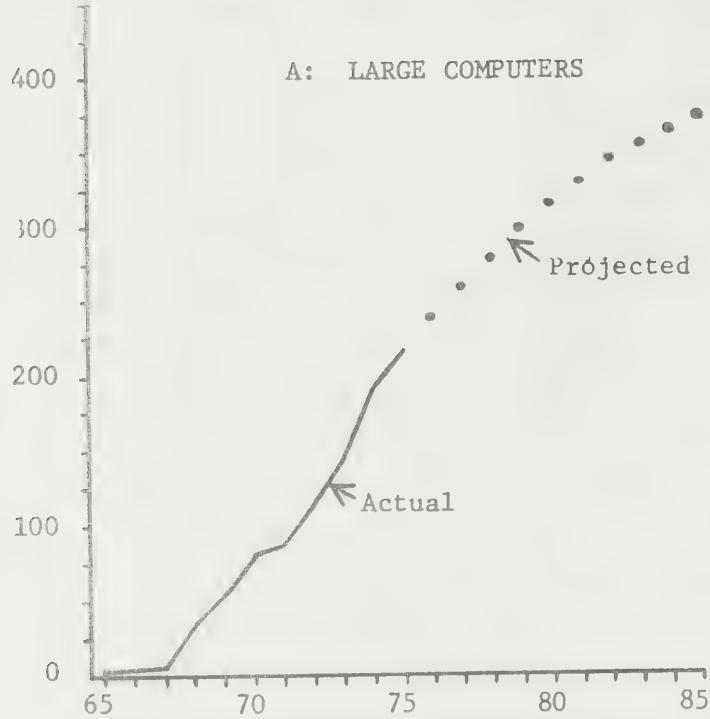
Some specific assumptions involved in fitting "S" curves or calculating values for each computer group were as follows:

- a. Large machines (\$600,000 and over annual rental equivalent): The increase in number of these machines has slowed but remains high; they are therefore assumed to be just past the mid-point of their S-curve. The average value of these machines is expected to increase at about 5% per year.

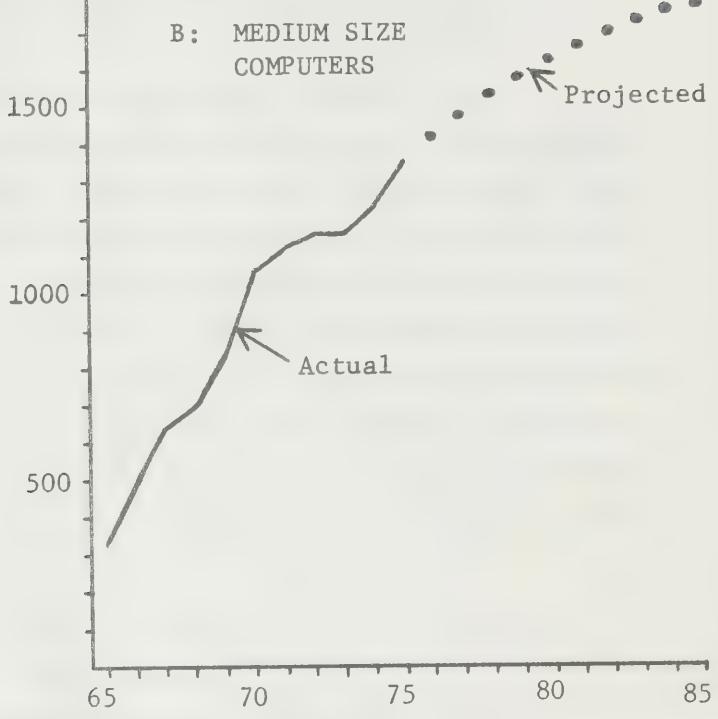
Chart VII:

ACTUAL AND PROJECTED INCREASE IN NUMBER
OF COMPUTERS, BY SIZE GROUP

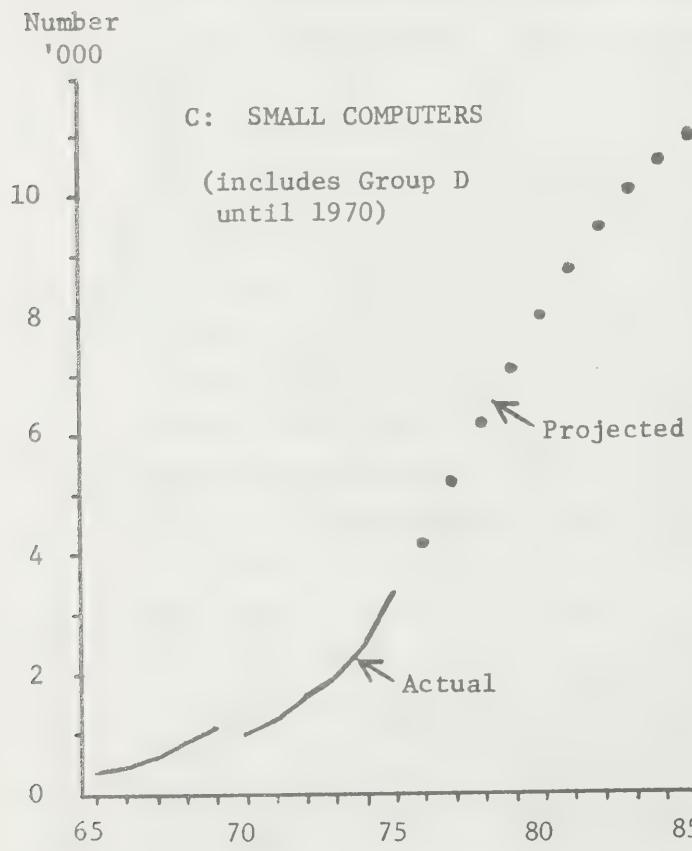
Number
of
Computers



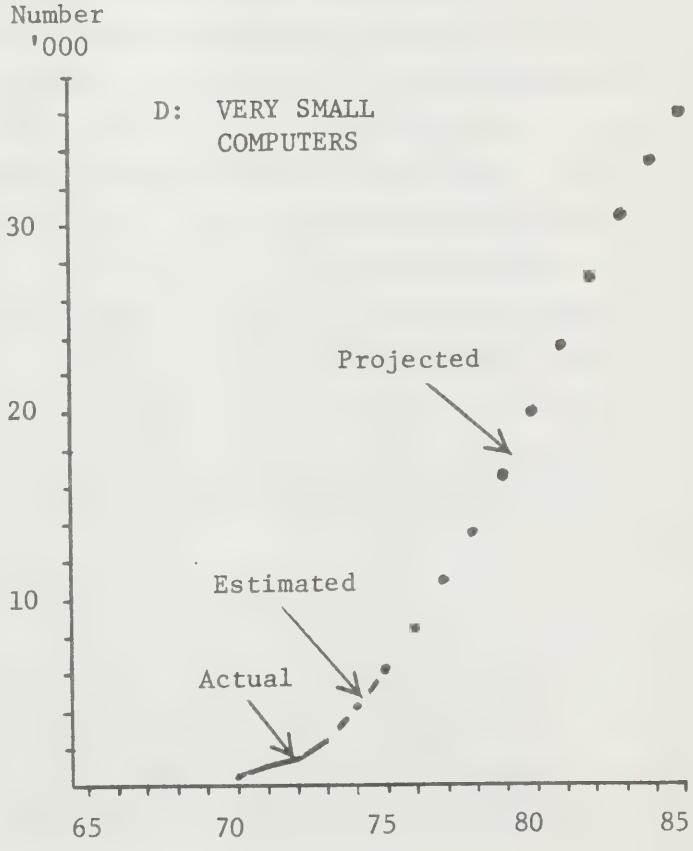
Number
of
Computers



Number
'000



Number
'000



- b. Medium-size machines (\$60,000-\$599,999 annual rental equivalent): The increase in number of these machines has already fallen off to a low level in spite of the relatively sharp jump in the 1975 census; they are therefore assumed to be well past the mid-point of their S-curve. A very small increase (0.6% per annum) in average rental per computer is assumed in line with estimates for 1970-1975.
- c. Small machines (\$12,000-\$59,999 annual rental equivalent): The increase in number of these machines is assumed to be approaching the mid-point of its S-curve, and expected to fall off noticeably after 1977 or 1978. The average value of these machines is expected to continue the decline which has been evident for the last five years. No early saturation of this market can be expected in view of the trend to distributing computing.
- d. Very small machines (under \$12,000 annual rental equivalent): This category was first identified by CIPS in the 1970 Census, and was dropped after 1973, although enough summary data continued to appear to provide a basis for estimates. These data - and forecasts appearing in the trade press - suggest that this group has just entered its period of rapid increase, and that year to year increases in numbers may grow until the end of the 1970's. Many of the devices included here - although capable of computing according to the CIPS definition - are principally used as terminals. A rapid growth in intelligent terminals is certain to accompany the spread of distributing computing.

The compound growth rates for 1975-1985 which resulted from this process are as follows:

	Number of Computers		Annual Rental Value	
	1975-80	1980-85	1975-80	1980-85
	%	%	%	%
Large computers	8	4	13	9
Medium-size computers	4	2	4	2
Small computers	19	7	15	3
Very small computers	26	12	26	12

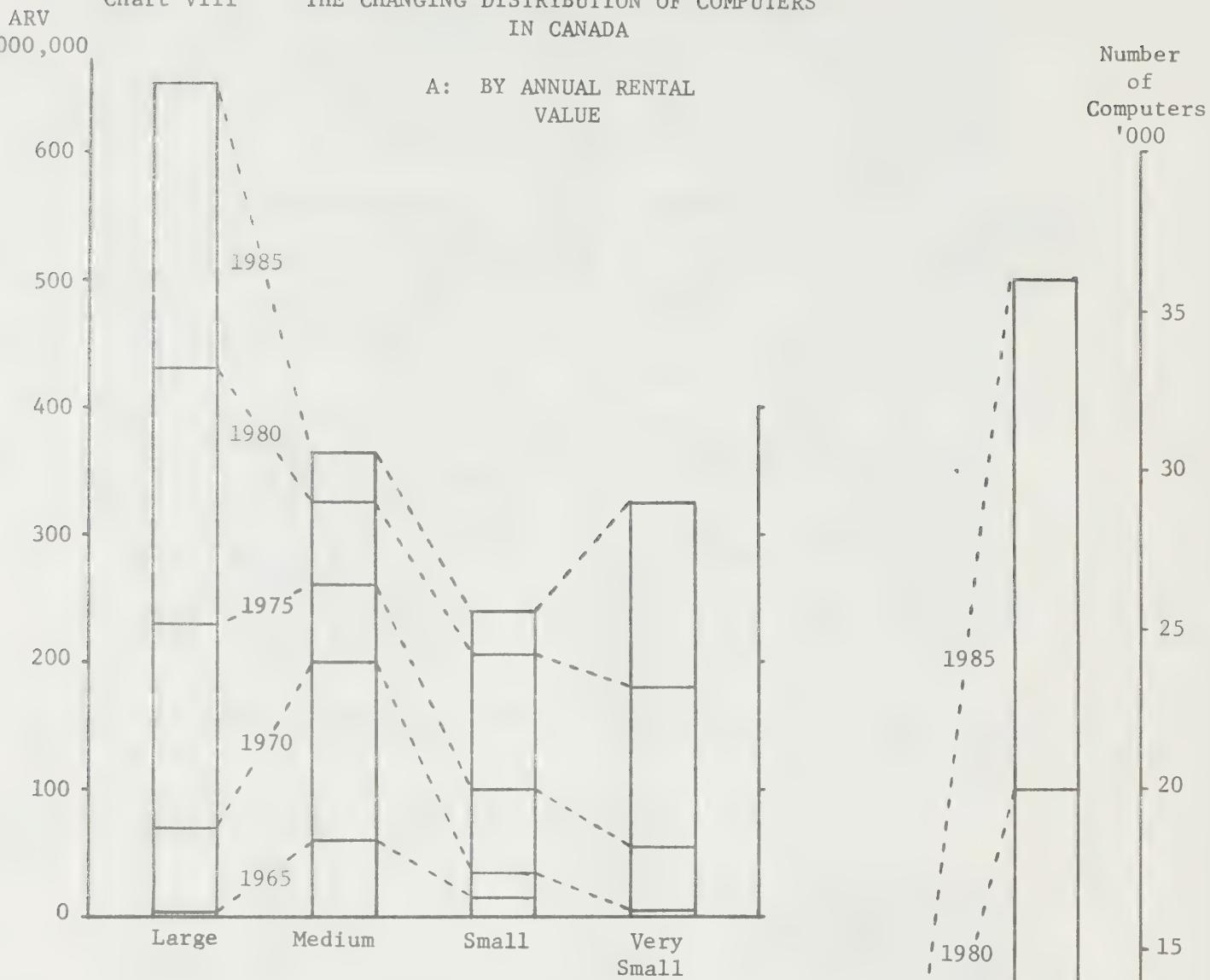
Chart VIII depicts the changing distribution of computers in Canada among the four groupings used in this forecast. Sharp changes in the pattern of installed and expected capacity are immediately apparent.

As recently as 1970 there were more computers in the medium-sized group than in any other group (although small computers almost equalled medium computers in number). Almost two-thirds of the value of installed capacity was also in this group. By 1975, both very small and small computers (excluding micro-computers) were much more numerous than medium-scale configurations, and large computers (though fewer) accounted for almost as much of the annual rental value of all computer installations.

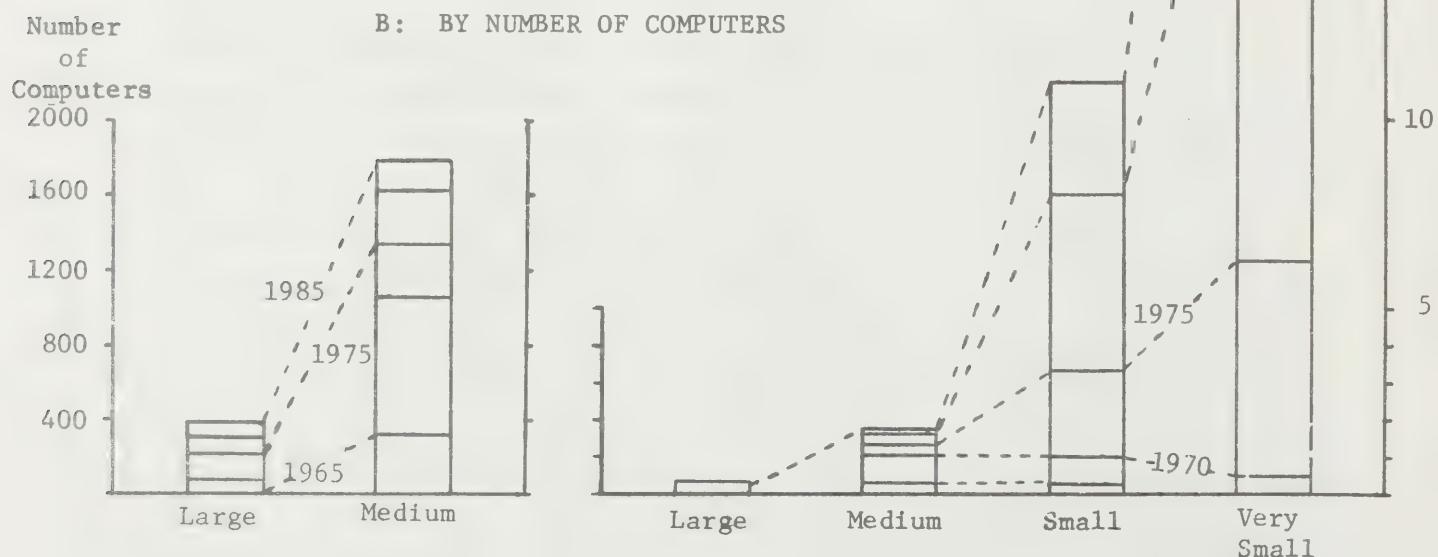
Chart VIII

THE CHANGING DISTRIBUTION OF COMPUTERS
IN CANADA

A: BY ANNUAL RENTAL
VALUE



B: BY NUMBER OF COMPUTERS



By 1985 the very small machines seem likely to outnumber all other types together, and both small and very small machines seem likely to account for almost as much of annual rental value as do medium-scale configurations. The value of large machines seems likely to be almost twice as great as that of any other category.

The present and now-expected distribution of computers is quite different than expected by the Computer/Communications Task Force in 1971. The earlier estimates were for a much greater number of large and medium sized configurations, a much smaller number of small and very small configurations. These differences indicate important changes in both the pace and the nature of computerization from the expectations held in 1971. They also provide an indication of how great is the margin of error to which even the most careful forecast is exposed in this fast-changing field!

The forecast also indicates reason for concern about the continued availability of the CIPS data base. In 1974, when the total population of computers passed 8,000, CIPS found it necessary to cease tabulating and publishing entries for computers with an annual rental value below \$12,000. They have not yet published a census listing as many as 6,000 computers. Yet, if even the present coverage is to be maintained, the 1976 census will be the largest volume to date, and the 1977 census will approach 7,000 listings. Either by 1977 or by 1978 some further cuts in coverage seem likely. Elimination of computers with an annual rental value below \$24,000 would reduce coverage by just over 1/3 in number, according to 1975 data. While the loss in value would be only 5%, the census would become much less valuable as a basis for other surveys.

The federal government does have an interest in the continued availability of this information. It has been useful to several task forces. It provides the basis for Statistics Canada's survey of the Computer Service Industry. At present, it even provides the only available inventory of the government's own computer installations! It is very unlikely that the government could itself compile data of equivalent coverage and accuracy at

a cost as low as incurred by CIPS because of the substantial voluntary (and unpaid) effort provided by many CIPS members across the country.⁵

Reference Table V indicates that the present coverage of the CIPS Census should continue to provide a good indicator of the growth of installed computing equipment in Canada for some years to come. It also indicates the difficulties likely to face any attempt to compile statistics on very small computers.

5. The lack of such reliable data in the United States is cited as a problem in Dolotta et al., op. cit., p. 89.

IV. USE OF THE MODEL IN FORECASTING

The model of computer/communications developed in Part II provides a useful tool for integrating components of a forecast and ensuring their consistency, and for making estimates from partial data. While it does not simplify the forecasting process, since it forces consideration of interrelationships which might otherwise be glossed over, it does permit the handling of a range of necessary detail in a disciplined manner.

A. Necessary Inputs to the Model

This section indicates the components which must be considered in using the model in forecasting, and sets forth the basis for those used in our present forecast. The key components are a distribution of end user and service supplier costs, and a distribution of hardware supplier markets.

1. Changing Patterns of Costs

At present the only statistics from which cost trends can be estimated are those published by the Treasury Board. It will be at least two years before Statistics Canada data become useful in this way. In the meantime, some care is necessary in applying trends suggested by figures for government users to the whole user population, or to computing service suppliers.

Three very obvious trends are apparent in Reference Table VI. First is the decreasing proportion of expenditure on personnel; second, the increasing use of purchased computing services, third, the increasing proportion of expenditure on data transmission. The apparent reversal of all three trends in estimates for 1977-78 can perhaps be given little weight; comparison of the figures for 1975-76 and 1976-77 published in the 1974 and 1975-76 reports show that in all three cases the later figures are much more closely aligned with the apparent trend than were the first estimates.

To the extent that employee benefits contribute to the trend in personnel costs, this trend should be modified for application to all users. Governments in the past usually led the private sector in non-salary benefits provided to their employees. Private sector benefits can be expected to show some degree of catch-up during the next decade.

There is no evident reason for modifying the trend in purchased computing services for application to either users in general or to computing services suppliers. The trend in data transmission seems likely to be exaggerated in government figures because of undercounting in the earlier years and the sudden impact of a single major system from 1972-73.

Two less obvious trends in Treasury Board data are a decline in the proportions of spending on equipment (actual and imputed rental, and maintenance) and on other costs. The Treasury Board data on equipment are presented in three groups. The coverage of the figures appears to have improved with the specification of maintenance in 1971-72, and again in 1973-74 when imputed rental was separated. These discontinuities appear to suppress a slow decline which was evident in data for 1967-68 to 1970-71, and again from 1973-74 to 1975-76. The apparent reversal of this trend after 1975-76 is subject to the identical doubt as applied to the apparent trend reversals discussed above.

The trend in EDP support costs also appears to be affected by the more specific data which first become available for 1973-74, and by improvements in these estimates in the second issue of the Review of EDP in the Government of Canada. Also important in interpreting this total are the very low figures for production supplies recorded in 1971-72 and 1972-73. If allowance is made for these factors, a downtrend becomes at least very probable.

The same trends should apply to user costs and to distribution of computing services revenues. Since the latter must also contain an allowance for profit - or the funds needed for growth will not be available - the other trends must be accentuated or moderated accordingly. It is believed - though with very little hard evidence - that computing services sellers as a group probably lost money in 1970, and had relatively low equipment utilization ratios. A pre-tax profit position is shown in Statistics Canada data for 1974, but not one which would be sufficient to ensure long run capital availability. The pre-tax profit ratio must continue to improve to at least 10% by 1980 and 12% by 1985. The possibility of such improvement is demonstrated by United States data ¹; if it is not achieved in Canada then Canadian suppliers will lack the resources for continued successful competition.

1. 1976 ADAPSO Report, op. cit., p. 30, 31.

2. Changes in Hardware Markets

The principal changes in the distribution of computing hardware markets seem likely to be a gradual increase in the shares accounted for by computing service suppliers and by other hardware suppliers, and a decrease in the excess of capitalized sales over current depreciation allowances, and in end users' shares. The increase in the share of computing service suppliers will probably be less than in their share of end user costs, as specialists must develop a growing advantage in the ability to get the most out of their equipment. The growth in relative sales to other hardware suppliers is in line with the importance of such sales to mini-computer firms, and with the growing importance of this class of computer (developments in microcomputers may depress but seem unlikely to reverse this trend). The revenue/cost excess might easily become a negative amount by 1980 or 1985; if so, the more conservative downtrend included in our present estimates results in an underestimate of total user costs.

Reference Table IX summarizes the estimates for these factors used in our calculations for 1970, 1975, 1980 and 1985, together with those developed for 1974.

B. The Application of the Model

The chief value of the model in the forecasting process was that it forced specific consideration of the factors discussed in section A, and that it demonstrated when the numeric expressions of the various trends were out of balance. Several passes were necessary to obtain equilibrium results which were truly consistent with all trends assessed. The steps in the calculation process were as follows:

- a. Computing Hardware Revenues: These were estimated by extrapolating from the Statistics Canada total for 1974 on the basis of the trend shown in the estimated annual rental value of computer configurations, as adjusted to reduce the configuration share of total equipment revenues from 90% (for 1975) ² to 85% (by 1985). This may underestimate the likely decline in configuration shares of total equipment, although it is believed that the total configuration values used in compiling the CIPS Census and reported to Treasury Board by departments already include the values of a substantial proportion of all terminals which access these configurations. A steeper decline in configuration shares (if not offset by lower average values per configuration) would increase estimated values for 1980 and 1985.

2. Based on the ratio of configuration to total equipment noted by Treasury Board for 1971 and 1973.

b. User Costs and Computing Services Revenues: These were calculated from the respective dollar values contributed to hardware revenues according to the assumed shares of hardware costs in the totals.

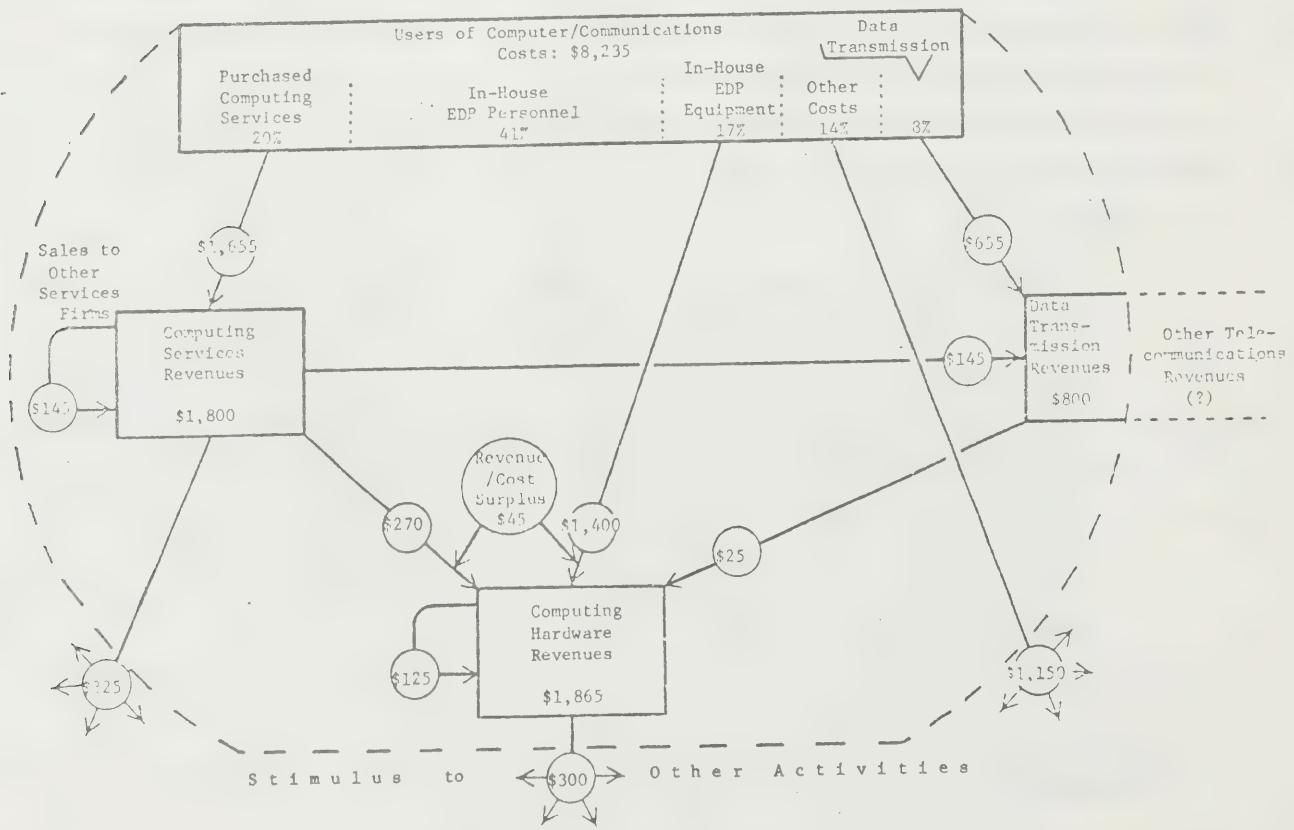
c. User Costs for Purchased Computing Services and Computing Service Revenues from Users: These were calculated from the totals at step b and compared. All assumed inputs to the model were then reviewed and adjusted and the process repeated until these two calculations yielded the same result!

d. Other Values: Other values were then calculated and reviewed for consistency with original assumptions. No difficulties were encountered at this step.

A set of calculations for 1970, 1975, 1980 and 1985 - with some trends deliberately set at what were considered to be upper limits - were reviewed with representatives of computing services, hardware supplier and data transmission supplier interests. Comments and questions which arose during and after these reviews were taken into account in refining the trends assumed. The data in Reference Tables V, IX and X incorporate the results of these discussions.

Chart IX illustrates the results of our calculations for 1985. The relative sizes of the boxes in this chart are roughly proportionate to 1985 values, as the boxes in Chart VI were roughly proportionate to 1974 values.

Chart IX
COMPUTER/COMMUNICATIONS REQUIREMENTS IN CANADA, 1985
(Values in \$'000,000)



C. Comparisons With Other Data

The validation of predictions of the future is possible only with the passage of time, and predictions are rarely confirmed. Their chief value is in alerting analysts to what to watch for as new data become available, and in helping to identify areas in which earlier expectations are not being borne out. Agreement among current forecasts of the future may be interesting, but can not be taken as strengthening their probability. Contrasts between forecasts made at different times may, however, throw useful light on how actual developments have departed from earlier expectations, and may suggest areas where earlier assumptions require reconsideration.

When the techniques used in a forecast are extrapolated to an earlier period (a backcast?), some inferences can perhaps be drawn either as to the validity of the techniques (not the results), or as to the interpretation which should be given to earlier partial data.

This section reviews comparisons with the Task Force forecast included in "Branching Out", with Statistics Canada data for 1972 and 1973, and with Treasury Board data, all resulting from the use for earlier periods of the same techniques used in preparing estimates for 1975, 1980 and 1985.

1. Comparisons with "Branching Out"

The data presented in Branching Out indicated a 1970-71 user expenditure on computer/communications of about \$940 million, including user salaries and wages. This expenditure was expected to increase to \$4 billion by 1980.³ The present estimates are that user costs totalled \$1,130 million in 1970 and will reach \$5.2 billion by 1980.

In 1971 the importance of indirect EDP support costs in computing was only beginning to be appreciated, and no data were available from which a reasonably accurate estimate of their magnitude could be made. The present estimates take account of the full range of costs indicated in Statistics Canada and Treasury Board statistics. As shown in Reference Tables VII and VI, these support costs actually account for some 20% of the total. This is approximately the difference between the totals in the present picture of 1970 and those presented in "Branching Out".

3. op. cit., pp. 40, 41, 44, 58, 59.

There are both similarities and differences in the components of the two pictures of 1970. The estimates for user purchases of computing services are almost identical - \$135 and \$133 million - and those for computing hardware revenues are quite close - \$340 and \$375 million. The current estimate for data transmission revenues - \$30 million - bears no resemblance to the earlier estimate for data communications - \$120 million - because the concepts are entirely different (already discussed in II-C-4). Another sizeable difference is in the "other goods and services" category - \$285 million versus \$80 million; this reflects the present inclusion of the full range of EDP support costs such as accommodation, transportation, accounting, legal and similar professional services, while Branching Out focussed on the sort of direct costs usually included in in-house data processing budgets.⁴

The same causes affect the components of the two pictures for 1980, somewhat altered by the differences in forecast assumptions. The present estimate of computing services revenues in 1980 is twice the Branching Out figure - \$ 1 billion versus \$513 million - and the hardware estimate is lower - \$1.3 billion versus \$1.6 billion. Branching Out reflected the then-current doubts about the viability of commercial computing services enterprises, and expected hardware to form a greater part of 1980 costs than seems likely today. The gap between the estimates for data communications - \$370 million and \$683 million - is still appreciable but proportionately less than for 1970. Both forecasts expect data communications to grow at the expense of conventional message traffic.

2. Comparisons with Computer Service Industry Reports

Comparisons can be made between estimates based on the model and some figures published in the first two Computer Service Industry reports for 1972 and 1973. The model suggests total revenues from the sale of computer services of \$205 million and \$240 million in these years. The Statistics Canada report suggests \$185 million and \$235 million, respectively (including the 5% addition used for 1974). The diminishing percentage difference between these totals is consistent with the hypothesis of a steady improvement in the coverage of the report in this difficult area, an hypothesis which is supported by the steady increase in establishments reported by Statistics Canada.

The relationship between model estimates and Statistics Canada figures for computer hardware revenues is less easy to explain. The respective figures

4. This practice is still followed in most U.S. surveys of data processing.

for 1972 are \$435 million and \$395 million - a gap of about 10%. For 1973 the respective figures are \$495 million and \$425 million, about 16% apart. Some establishments are known to have been shifted from the Statistics Canada "long form" to the "short form" for the 1973 survey, but this should not have increased the gap when activity revenues are consolidated. The small increase shown by the Statistics Canada total from 1972 to 1973, and the very large increase in the following year do not compare well with other indicators such as imports, the estimated rental value of computers, or estimated federal government equipment rentals.⁵

3. Comparisons with Federal Government Costs

The model's estimates for 1970-1975 were compared with Treasury Board statistics for the fiscal years ending in the following March. Treasury Board statistics form the following percentages of model totals (fiscal years ending March 31 compared with the calendar year ending in the previous December):

	1970 %	1971 %	1972 %	1973 %	1974 %	1975 %
Total User (EDP) Costs	7.1	8.3	8.7	9.8	9.4	9.3
User Personnel Costs	7.6	9.4	9.4	10.1	9.7	9.4
Computing Service Revenues	5.4	5.7	6.8	7.9	8.1	7.5
Computing Hardware Revenues	5.2	6.3	6.9	7.9	7.1	7.3
Data Transmission Revenues	0.7	1.0	2.8	4.7	4.0	5.5

These data illustrate the same relationships as were observed for 1974 (Section II-D-2). The government's share of total user costs and of user personnel costs is consistently above its share in (contribution to) the three activity revenue totals. Its share in all totals rose steadily from 1970 to 1973. In 1974 its share of all but computing services fell off, but this also declined in 1975, although the percentages for hardware revenues and data transmission revenues rose again in that year.

An increase in the government's contribution to computing services revenues between 1970 and 1974 would be in keeping with EDP administrative policy; the decline in this percentage in 1975 with the sort of restraints on spending implemented in that year. Hardware percentages which are below the percentages for total costs could reflect long depreciation periods for government-owned equipment, especially if combined with average or above-average proportions of owned equipment. No evidence is readily available to test this hypothesis.

5. See Appendix A.

The low percentage shown for data transmission revenues - especially for 1970 and 1971 - probably reflects the coverage of the government figures. Only one major communications-oriented system is included, and it was not fully operational until 1973. The below-average government rates for leased lines are also relevant, especially in interpreting the more recent (and probably more complete) figures.

D. Will the Expected Growth Occur in Canada?

Computer/communications has grown much more rapidly than most other economic activities during the last decade. The pace of growth indicated by our forecast will remain above that of most other activities for the next decade, though this lead is expected to decline as computer/communications matures. The indicated compound growth rates of user costs (total computer/communications) and of the three supply activities are as follows:

	<u>1970-75</u> %	<u>1975-80</u> %	<u>1980-85</u> %
User Costs (Total C/C)	18	14	10
Data Transmission Revenues	32	25	17
Computing Services Revenues	25	19	12
Computing Hardware Revenues	16	12	7

The growth of computer/communications relative to other activities could increase the amount of stimulation from this source which is available to other activities. The 1985 model shows direct flows of \$1.8 billion to other economic activities, and personnel costs (to users, computing services suppliers, and computing hardware suppliers) will total some \$4.5 billion. The growth of data communications and computing services relative to computing hardware might also be assumed to provide an increase in stimulation to the Canadian economy, since hardware expenditures have to date resulted in a much larger leakage through imports than have the other two.

In fact, the only part of the forecast growth which can properly be assumed to take place in Canada is that in user costs. Computing services can easily be imported, and if computing services are imported then foreign suppliers are likely to receive most of the associated data communications revenues. And not only can purchased computing services be imported, but in-house services can also be obtained from a corporate office located outside Canada. Where the computers and computing employees necessary to serve the needs of Canadian users will be located, and which carriers will gain from the expected growth

in remote computing, will depend on the relative costs of obtaining this input to other activities from Canadian or foreign suppliers.

During the past five years, in spite of some substantial and growing cost disadvantages, Canadian suppliers of commercial computing services appear to have competed successfully with foreign suppliers. Although actual statistics are not available, there are indications that exports and imports of commercially marketed computing services are about equal. There is no known indication of the extent to which foreign-based parent companies supply computing services to Canadian subsidiaries, or Canadian head offices draw computing services from foreign-located branches. If such imports are substantial today then user costs are underestimated by the model.

In spite of the economic doctrine that international trade - in the long run - is based on comparative rather than absolute costs, in the short run absolute costs levels do matter. And computer/communications is developing and changing so rapidly that its future location and the resulting patterns of trade and communications flows are likely to be determined by conditions which apply in relatively short periods of time.

A considerable investment in computing facilities, communications facilities and staff development and training will be required to meet the growing demand for computer/communications outputs. These investments must keep pace with the increase in demand for computer/communications services, and some appear to require substantial lead times. If necessary investments are not made in Canada - or are not made in time - then the likelihood that a growing part of Canadian requirements for computer/communications outputs will be met by imports will be increased.

Whether the necessary investments are made in Canada will depend on the quality of planning by Canadian enterprises and governments, and on business perceptions of the likely costs of producing required services in Canada or elsewhere. The effects of government policies on costs and on service alternatives can clearly have considerable influence on the critical developments of the next few years.

If the federal government wishes to maximize the Canadian share in meeting Canadian needs for computer/communications, and is to be able to

monitor the success of its policies in achieving this objective, then it will require reliable data on the export and import of computer/communications services. Such data cannot be provided by a producer-based survey like that of the Computer Service Industry, but might be developed from such sources as are now used in balance of payments accounting. These data are most unlikely to become available from any non-government source.

APPENDIX A

CURRENT STATISTICS RELATING TO COMPUTER/COMMUNICATIONS

There are four principal independent series of current statistics relating to computer/communications in Canada. These are the annual Computer Census published by the Canadian Information Processing Society (CIPS), the annual Computer Service Industry (CSI) report and the commodity export and import statistics published by Statistics Canada, and the Review of EDP in the Government of Canada published by the federal Treasury Board. None of these sources alone provides sufficient data for an adequate overview of computing in Canada, and even when used together there are important gaps in coverage. The characteristics of each of these series will be briefly reviewed.

Other sources of quantitative data include the salary surveys conducted by CIPS and by Peat Marwick and Partners, and articles available in the trade and financial press, especially the publications of R.W. Evans Associates Ltd. Some Canadian data are published by International Data Corporation, and UN and OECD studies often contain estimates relating to some aspects of computer/communications in Canada.

1. The CIPS Canadian Computer Census

The CIPS Computer Census has been published each year starting in 1965. It is a voluntary mail survey conducted by the oldest Canadian association of persons interested in data processing. CIPS defines a computer to be any "device capable of accepting, processing and supplying data under the control of an internally-stored program which it has the ability to modify". Until 1973 the Census attempted to include all central processing units (CPU's) which met this definition, even those CPU's which are incorporated as controllers in another machine such as a key-to-tape unit. Starting with 1974 the Census has excluded computers renting for less than \$1,000 per month. In this paper estimates of the number of computers "below \$1,000" have been made for 1974 and 1975 from data published in the CIPS Census.

The CIPS Census is without question the broadest and most general indicator of computer use in Canada.¹ The data seem to provide very good coverage within

1. See Reference Tables III and IV, (pp. 55-56).

the limits of Census objectives, and to be quite consistent from period to period. This consistency even applies in such difficult areas as industry classification (although it should not be assumed that the industry classes are necessarily identical with those appearing in other sources). The "feedback" technique used in the Census, whereby last year's answers are reproduced on the current year's Census questionnaire and may be corrected by the respondent as a substitute for re-entering all data, probably makes an important contribution to consistency.

The CIPS Census lists each identified computer by location and firm (user), and identifies the computer model, installation date, rental or ownership status, memory size, number of tape drives and number of random access devices for each, as well as a few other characteristics. Tabulations are also provided based on the "rental class" and "industry" of each machine, but these data are not published in detail.

Two important facts about the CIPS Census must be kept in mind. First it is largely conducted by volunteers. Questionnaire design, mailing, follow-up, supplementary enquiries to manufacturers, processing and publication all depend on the voluntary effort of CIPS members. This limits the attention that can be given to data editing. Second, the CIPS Census form is designed to be filled in by data processing managers, and is limited to information readily available to those managers and releasable by them.

The CIPS Census has achieved a high reputation for completeness and accuracy. Some CIPS member will usually become aware of any sizable computer installed in any area within a reasonable time, and the name of the firm will find its way onto the CIPS mailing list. And considerable effort is made to avoid removing a computer from the census because of non-response. Comparison of an area sample of the 1970 Census with the same areas for 1969 and 1971 indicates that only 1.5% would have been added to the number of computers reported in 1970 had not some 1969 entries been dropped in error, and that some 7.6% would have been added in total had it also been possible to identify immediately all new computer installations. Similar results were obtained from a comparison of a 1972 Census sample with data for 1971 and 1973. Most of the computers omitted from both censuses were in the smallest size ranges, and a part of these omissions may have been offset by undetected double-counting.

The change in coverage of the 1974 Census appears to have roughly doubled the proportion of computers missed, and almost one-fifth of these appear to have been in the medium size range. A greater shortfall may be a systemic problem now that the effort to include all computers has been abandoned, since upgrades from the omitted area to the smallest class covered will be more difficult to detect. Until the 1976 CIPS Census is available, it will not be possible to validate this hypothesis.

It is necessary for many purposes to transform the numbers in the CIPS Census into estimated dollar values. For this paper they have been expressed as estimated annual rental values (ARV) by multiplying the number of computers reported in each rental class by the mid-point of the rental class range times 12 months. In estimating a value for computers with a monthly rental value below \$1,000, an arbitrary figure of \$750/month was assumed. In estimating a value for computers with a monthly rental value of \$50,000 or more, a value of \$70,000/month was assumed for 1970, and this value increased by 5% in each successive year to reflect the known tendency of large installed systems to add peripherals, etc., as their workload increases. Other variants of this value estimation technique were also tested (e.g., use of class interval values in which first the lower limit and then the upper limit was double-weighted, use of constant values in the \$50,000 and up class, and use of constant dollar escalation in the \$50,000 and up class), but none of these variants appeared to yield results which were as compatible with data from other sources.

No adjustment has been made to the CIPS figures used in this report to offset reporting errors. These appear to be sufficiently consistent from year to year to have little effect on trends, and because they are concentrated in small machines their impact on value estimates is probably of the order of 2% (except for 1974, where it still appears to be only about 4%).

2. The Computer Service Industry Report (Cat. 63-222)

Statistics Canada conducted its first survey of the Computer Service Industry for 1972. This mail survey provides more varied information than any source other than Treasury Board, and has a much wider coverage than the Treasury Board series. Although only three years' data are yet available, this report is of special value in estimating the magnitude of total computer/communications activity in Canada.

The Computer Service Industry report relates to the following groups of establishments:

1. Those whose principal source of revenue is the sale of computer services (machine-based or software).
2. Those whose principal source of revenue is the sale, lease or rental of computers and other data processing hardware.
3. Those who have important secondary revenues from either of the above sources.

The reports for 1972 and 1973 present one set of tables for the first two groups of establishments taken together. They show such important totals as number of employees and number of installed computers and terminals, and provide considerable detail on operating revenue resulting from sales of particular types of service and from sales to particular customer industries. There is also a table on operating expenses, but this is of limited value because of the differences in the nature of the business of the two classes of establishment included in the totals. Only summary statistics are available for the third group of establishments, and there is no information on operating costs (these are included in statistics relating to the industry which is the principal source of revenue for these establishments).

The format of the 1974 report was revised after consultations with various industry groups, and its basic plan was to present separate data for each of the first two groups of establishments. Unfortunately, the secrecy provisions of the Statistics Act prevent the publication for each group of some of the revenue details and important totals which could be provided for the total of the two groups in earlier years. An attempt has been made in this report to estimate some of the missing data. An offsetting gain - crucial to this paper - is that the data on operating expenses presented in 1974 relate to sufficiently homogeneous groups of establishments to be of real value.²

Users of these data must bear in mind the implications of the three-way classification of establishments by principal source of revenue. Some firms which were included in group 1 or 2 in the first survey year are known to have

2. See Reference Tables I, II, VII and VIII, (pp. 52, 53, 59, 60).

been reclassified to group 3 in the second survey year, and this type of reclassification can produce anomalies in year-to-year comparisons except when data for all three groups of firms are added together. Even when the broadest possible comparisons are made, some year-to-year comparisons appear anomalous, especially in some of the more detailed operating revenue and market totals. These are probably caused by reporting irregularities, which are extremely difficult to contend with, especially in the initial years of a new statistical survey.

The most interesting of these anomalies is in the total for hardware sales and rental. This total, for all three groups of firms reported in the Computer Service Industry report, increased by only 4% from 1972 to 1973, and by 43% from 1973 to 1974. These changes compare with changes in logically related series from other sources as follows:

	1972 to 1973	1973 to 1974	1972 to 1974
	%	%	%
Total Hardware Sales and Rental, CSI	4.4	43.0	49.4
Imports, Electronic Computers and Parts	30.3	20.3	56.8
Estimated Rental Value of Computers (CIPS)	13.3	22.7	39.0
Estimated Federal Government Equipment Rentals (TBS)	25.2	10.3	38.1

Statistics Canada has suggested that hardware sales and rentals by non-respondents may have been overestimated in 1972, the first survey year. However, in view of the relatively consistent total gains shown by all series between 1972 and 1974, this paper has interpreted the anomaly as indicating some unknown reporting or coverage error in the 1973 survey data. Estimates and projections should be interpreted in the light of this assumption.

3. Commodity Exports and Imports (Cat. 65-004 and 65-007)

A separate class for electronic computers and parts (771-22) was introduced in Canadian import statistics in 1964. This class contains only finished components of computer systems and parts of those systems, and does not include imports of materials from which components or parts may be assembled in Canada. A class for computer tape (634-78) was introduced in 1971. Identical classes

are not available in export statistics because of the secrecy provisions of the Statistics Act, but export class 771-21 covers the same commodities as import classes 771-20 and 771-22, and is known to be principally data processing equipment. Only values are reported.

The values for data processing equipment shown in both export and import statistics are based on the reports of exporters and importers to customs authorities. The import values are known to be based, in most cases, on manufacturing cost plus an allowance for profit, and to be usually much lower than the prices at which the goods would actually be sold to users in Canada (which must also recover the cost of operating software). Export values for data processing equipment are believed to be usually intra-company transfer values; fairly comparable with import values and also well below market values. Export and import values appear to be reasonably comparable with each other, but should be increased by a factor of two or more when being compared with such data as the Treasury Board series or the value estimates based on the CIPS Census.

4. The Treasury Board Statistics

The federal Treasury Board published in 1975 a "Review of EDP in the Government of Canada, 1974". This was the first public release of statistics relating to government data processing, although data have been gathered intermittently by the Board since 1968. These statistics are expected to be published each year as a by-product of the EDP planning system prescribed by the "Guide on EDP Administration for Departments and Agencies of the Government of Canada".³ Although reporting instructions and forms are distributed by mail, there is close personal and telephone liaison between Treasury Board officers and departmental officers preparing the returns.

The Treasury Board statistics relate to the production and use of EDP services by government departments and by agencies which have the status of departments under the Financial Administration Act. They exclude crown corporations and other commercial or semi-commercial agencies, and even for regular departments they exclude some special purpose computer applications which do not relate and cannot readily be adapted to general purpose data processing (specialized military applications and the air traffic control system are examples of these exclusions).

The Treasury Board data include tables on the nature of costs incurred to provide and support EDP services (from fiscal year 1967-68), the number and type of EDP staff employed (also from 1967-68),⁴ the types of EDP services utilized or expected to be needed and the principal sources of supply (from fiscal year 1973-74), and the regional distribution of EDP man-years, and of supply and use of non-government EDP services. Most tables include estimates for two years ahead. This could make the report especially valuable as a guide to likely short-run developments, since the federal government is the largest single EDP user in the country (although the statistics account for less than 10% of total estimated use). As yet, however, these forecasts display a tendency to revert to past patterns of EDP costs and use, rather than to fully reflect likely future developments.

The departmental returns from which these data are compiled are thoroughly reviewed for administrative purposes. They can be accepted as providing a reliable picture of the magnitude of federal government EDP activity within their defined scope. Data relating to the types of EDP services used and to sources of supply are probably subject to a wider margin of error than those relating to costs. Some EDP cost data have been gathered intermittently since 1968, but data on service type and source were first collected in 1974, and the classifications used have not yet become sufficiently familiar and stable to ensure year-to-year consistency.

One omission from the Treasury Board statistics is information on the number of computers installed in the federal government. This prevents use of this series as an independent check on the accuracy of the CIPS Census.

4. See Reference Table VI, (p. 58).

REFERENCE TABLES

A. ACTIVITY AND INDUSTRY

- I. Principal Statistics Reported by Statistics Canada, 1972-1974
- II. Industry and Activity Operating Revenues, by Source, 1974

B. COMPUTER POPULATION

- III. Number and Estimated Value of Computers Installed in Canada, 1965-1975
- IV. Percentage Distribution by Rental Class of Computers Installed in Canada, 1965-1975
- V. Estimated Number, Annual Rental Value and Distribution of Computers Installed in Canada, 1976-1985

C. COSTS AND REVENUES

- VI. Trends in Federal Government EDP Costs and Staff, 1967-68 to 1977-78
- VII. Government EDP Costs and Operating Expenses of Computer Services Firms, 1974
- VIII. User Cost and Supplier Revenue Distributions Used with Model, 1974
- IX. User Cost, Supplier Revenue and Equipment Market Distributions Used in Forecast, 1970-1985
- X. Estimates of Computer/Communications in Canada, 1970-1985

Table I PRINCIPAL STATISTICS REPORTED BY STATISTICS CANADA, 1972-1974

	<u>Unit</u>	<u>Industry Group</u>	<u>1972</u>	<u>1973</u>	<u>1974</u>
Establishments (firms)	No.	Services) Hardware) Other	309 329	331 405	(345 (35 381
Paid Employees	No.	Services) Hardware)	14,364	14,119	(8,956 (9,462
Salaries, Wages and Benefits	\$M	Services) Hardware)	165.7	180.1	(89.5 (154.9
Total Operating Revenue	\$M	Total Services) Hardware) Other	572.0 535.0 37.0	650.3 589.7 60.6	923.0 (210.9 (612.0 100.1
from Processing	\$M	Total Services) Hardware) Other	142.0 119.2 22.8	173.4 139.4 34.0	234.9* (140.9 (43.3*
- over the counter	\$M	Total Services) Hardware) Other	93.9 77.7 16.2	110.6 85.1 25.5	145.3* (80.6 (32.0*
- remote access (incl. communications line charges)	\$M	Total Services) Hardware) Other	37.2 32.5 4.7	49.4 42.8 6.6	71.0* (44.4 (11.0*
- input preparation	\$M	Total Services) Hardware) Other	10.9 9.0 1.9	13.3 11.5 1.8	18.4* (15.8 (0.3*
from Software	\$M	Total Services) Hardware) Other	30.3 27.5 2.8	41.9 36.1 5.8	62.0* (50.6 (2.5*
- software packages	\$M	Total Services) Hardware) Other	13.8 13.2 0.6	12.9 11.4 1.5	27.4* (24.7 (0.6*
- systems development	\$M	Total Services) Hardware) Other	16.5 14.2 2.3	29.0 24.7 4.3	34.6* (25.9 (1.9*

concluded

Table I PRINCIPAL STATISTICS REPORTED BY STATISTICS CANADA, 1972-1974,
concluded

	Unit	Industry Group	1972	1973	1974
Total Operating Revenue					
from Hardware Sales and Rental	\$M	Total Services) Hardware) Other	378.9 369.7 9.2	395.6 376.5 19.1	565.9 (6.7 (529.0 30.2
from Equipment Maintenance, Education and Other Services	\$M	Total Services) Hardware) Other	20.8 18.6 2.2	39.4 37.7 1.7	60.2 (12.8 (37.1 10.3
- equipment maintenance	\$M	Total Services) Hardware) Other	16.8 [@] 16.4 [@] 0.4 [@]	28.4 [@] 27.2 [@] 1.2 [@]	41.2 [@] (1.4 [@] (34.1 [@] 5.7
- education and other	\$M	Total Services Hardware Other	4.0 [@] 2.2 [@] 1.8 [@]	11.0 [@] 10.5 [@] 0.5 [@]	19.0 [@] (11.4 [@] (3.0 [@] 4.6
Operating Revenue Generated Outside Canada	\$M	Services) Hardware)	10.1	11.7	(10.7 (15.2
Number of Computers in Use	No.	Services) Hardware)	661**	303	(206 (148

Source: Statistics Canada, "Computer Service Industry" (Cat. No. 63-222, all issues) and correspondence. Estimates by C/CS as noted.

* The new publication format adopted for 1974 provided good industry cost data (which made our model feasible) but at the price of suppressing processing and software revenue detail for ADP Hardware firms. These details were estimated by C/CS on the basis of data for earlier years, and with allowance for trends.

@ Estimated by C/CS. The total estimate for equipment maintenance was based on the maintenance:hardware cost ratios derived from Tables VI and VII (5% for 1972, 8% for 1973 and 1974) converted from a user cost to a supplier revenue basis by multiplying by .9 (the approximate ratio of hardware costs to hardware revenues indicated by the model). The remainder, rounded to the nearest million, was used for education and other. These totals were then assigned by industry, with varying distributions.

** According to Statistics Canada, the drop in this figure after 1972 was due to some reclassification of respondents to the "Other" group, and to incorrect inclusion by respondents in 1972 of computers rented to others.

Table II INDUSTRY AND ACTIVITY OPERATING REVENUES, BY SOURCE, 1974

Activities and Sources of Revenue	Computer Services Industry	ADP Hardware Industry	Other Industries	Activity/Revenue Totals
		\$'000		
<u>Total Operating Revenue</u>	<u>210,950¹</u>	<u>611,965²</u>	<u>100,078</u>	<u>922,993</u>
<u>Computing Services Activity</u>	<u>202,831³</u>	<u>48,852³</u>	<u>64,172³</u>	<u>315,855³</u>
Computer processing	125,015	43,047 ⁴	48,317	216,379 ⁴
- local	80,611 ⁵	32,047 ⁴	32,676	145,334 ⁴
- remote	44,404	11,000 ⁴	15,641	71,045 ⁴
Input preparation ⁶	15,840	300 ⁴	2,336	18,476 ⁴
Software packages ⁶	24,671	600 ⁴	2,165	27,436 ⁴
Systems development ⁶	25,905 ³	1,905 ³	6,754 ³	34,564 ³
Education and other	11,400	3,000 ⁴	4,600 ⁴	19,000 ⁴
<u>Computing Hardware Activity</u>	<u>8,119³</u>	<u>563,113³</u>	<u>35,906³</u>	<u>607,138³</u>
Sales of equipment, goods		221,803		
- purchased for resale		164,813		
- manufactured in Canada	6,734 ⁷	56,990		
Rental of equipment, goods		307,213		
- purchased for rental		304,625		
- manufactured in Canada		2,588		
Equipment maintenance	1,385 ³	34,097 ³	5,760 ³	41,242 ³

Source: Statistics Canada, and estimates by C/CS.

1. Includes \$10,700,000 generated outside Canada.
2. Includes \$15,200,000 generated outside Canada.
3. Statistics Canada totals for "Equipment maintenance, education and other" (cols. 1 and 2) and "All other computer revenue" (col. 3) were subdivided to obtain activity components. Equipment maintenance was calculated from the maintenance:hardware cost ratio derived from the Computer Services Industry and Government EDP cost analyses (about 8% - see Table VII) converted to a revenue basis by multiplying by .9 (approximate ratio of hardware cost to hardware revenue). The remainder, rounded to the nearest million, was used for Education and other. These totals were then assigned by industry, with varying distributions.
4. Only one ADP Hardware total for these items was published by Statistics Canada for 1974. These estimates are based on the pattern of activity totals published for 1972 and 1973, with allowance for trends.
5. Includes revenues identified as "communications line charges".
6. Data for 1972-1974 suggest that this distinction may not be consistently applied by respondents to the Statistics Canada survey (see Table VI).
7. No basis in earlier reports for subdividing these amounts. The Other Industries distribution would likely be similar to that for ADP Hardware; the Computer Services Industry would likely show a higher "manufactured in Canada" content.

Table III

NUMBER AND ESTIMATED VALUE OF COMPUTERS INSTALLED IN CANADA, 1965-1975

Source: Canadian Information Processing Society:Canadian Computer Census. Valuation estimates by C/CS.

ARV = Annual Rental Value.

The S/CS interpolated 5 balanced by deduction from the next group

The C/CS Interpolated β , balanced by deduction from the next group.
e Estimated by C/CS, largely from data published in CIPS Census.

Table iv PERCENTAGE DISTRIBUTION BY RENTAL CLASS OF COMPUTERS INSTALLED IN CANADA, 1965-1975

	1965	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975
% of All Computers											
All Computers	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
ARV \$12K up	—	—	—	—	—	80.2	69.8	66.6	57.3	47.7	44.2
Large Computers											
ARV \$600K up	0.4	0.5	0.5	2.3	2.7	3.0	2.5	2.6	2.5	2.3	1.9
Medium Computers	<u>46.3</u>	<u>51.7</u>	<u>50.4</u>	<u>43.5</u>	<u>41.3</u>	<u>39.2</u>	<u>31.5</u>	<u>26.3</u>	<u>20.2</u>	<u>15.0</u>	<u>12.1</u>
ARV \$240K-\$599K	<u>6.3</u>	<u>7.5</u>	<u>7.2</u>	<u>8.4</u>	<u>8.2</u>	<u>8.1</u>	<u>6.6</u>	<u>5.9</u>	<u>4.5</u>	<u>3.5</u>	<u>2.8</u>
ARV \$120K-\$239K	23.7	14.1	16.8	15.4	15.7	13.2	10.3	8.1	6.5	4.5	3.8
ARV \$60K-\$119K	16.3	30.1	26.4	19.7	17.4	17.9	14.6	12.3	9.2	7.0	5.5
Small Computers	<u>53.3</u> ^①	<u>47.8</u> ^①	<u>49.1</u> ^①	<u>54.2</u> ^①	<u>56.0</u> ^①	<u>38.0</u>	<u>35.8</u>	<u>37.7</u>	<u>34.6</u>	<u>30.4</u>	<u>30.2</u>
ARV \$24K-\$59K	<u>42.3</u>	<u>39.0</u>	<u>36.5</u>	<u>31.3</u>	<u>27.5</u>	<u>26.3</u>	<u>22.4</u>	<u>21.9</u>	<u>19.7</u>	<u>16.2</u>	<u>14.9</u>
ARV \$12K-\$23K	11.0	8.8	12.6	22.9	28.5	{ 11.7	13.4	15.8	14.9	14.2	15.3
Very Small Computers						{ 19.8	30.2	33.4	42.7	52.3	55.8
ARV below \$12K											
% of All Computers ARV											
All Computers	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
ARV \$12K up	—	—	—	—	—	98.4	97.2	96.6	95.1	93.0	91.4
Large Computers											
ARV \$600K up	2.7	3.5	3.8	15.2	19.0	22.3	22.8	26.9	31.2	35.6	35.7
Medium Computers	<u>79.1</u>	<u>79.8</u>	<u>80.0</u>	<u>70.6</u>	<u>67.7</u>	<u>64.6</u>	<u>62.0</u>	<u>56.3</u>	<u>49.9</u>	<u>43.5</u>	<u>40.2</u>
ARV \$240K-\$599K	<u>25.1</u>	<u>29.9</u>	<u>28.7</u>	<u>30.9</u>	<u>29.7</u>	<u>29.8</u>	<u>28.9</u>	<u>27.8</u>	<u>24.3</u>	<u>22.2</u>	<u>20.1</u>
ARV \$120K-\$239K	40.2	24.1	28.7	24.2	24.4	20.7	19.4	16.2	15.0	12.0	11.6
ARV \$60K-\$119K	13.8	25.8	22.6	15.5	13.6	14.1	13.7	12.3	10.6	9.3	8.5
Small Computers	<u>18.2</u> ^①	<u>16.7</u> ^①	<u>16.2</u> ^①	<u>14.2</u> ^①	<u>13.3</u> ^①	<u>11.5</u>	<u>12.4</u>	<u>13.4</u>	<u>14.0</u>	<u>13.9</u>	<u>15.5</u>
ARV \$24K-\$59K	<u>16.7</u>	<u>15.6</u>	<u>14.6</u>	<u>11.5</u>	<u>10.0</u>	<u>9.7</u>	<u>9.8</u>	<u>10.2</u>	<u>10.6</u>	<u>10.1</u>	<u>10.8</u>
ARV \$12K-\$23K	1.5	1.1	1.6	2.7	3.3	{ 1.8	2.6	3.2	3.4	3.8	4.7
Very Small Computers						{ 1.6	2.8	3.4	4.9	7.0	8.6
ARV below \$12K											

① ARV = Annual Rental Value.

② Includes very small computers before 1970.

Table V

ESTIMATED NUMBER, ANNUAL RENTAL VALUE AND DISTRIBUTION OF COMPUTERS INSTALLED
IN CANADA, 1976-1985

	<u>1976</u>	<u>1977</u>	<u>1978</u>	<u>1979</u>	<u>1980</u>	<u>1981</u>	<u>1982</u>	<u>1983</u>	<u>1984</u>	<u>1985</u>
<u>Number of Computers - Total</u>	<u>14,355</u>	<u>17,935</u>	<u>21,710</u>	<u>25,680</u>	<u>29,940</u>	<u>34,395</u>	<u>38,745</u>	<u>42,685</u>	<u>46,220</u>	<u>49,150</u>
- ARV \$12K up	<u>5,855</u>	<u>6,935</u>	<u>8,010</u>	<u>8,980</u>	<u>9,940</u>	<u>10,795</u>	<u>11,545</u>	<u>12,185</u>	<u>12,720</u>	<u>13,150</u>
- Large	240	260	280	300	315	330	345	355	365	375
- Medium	1,415	1,475	1,530	1,580	1,625	1,665	1,700	1,730	1,755	1,775
- Small	4,200	5,200	6,200	7,100	8,000	8,800	9,500	10,100	10,600	11,000
- Very small	8,500	11,000	13,700	16,700	20,000	23,600	27,200	30,500	33,500	36,000
<u>Increase in Year - Total</u>	<u>28.5</u>	<u>24.9</u>	<u>21.1</u>	<u>18.3</u>	<u>16.6</u>	<u>14.9</u>	<u>12.6</u>	<u>10.2</u>	<u>8.3</u>	<u>6.3</u>
- ARV \$12K up	<u>18.5</u>	<u>18.4</u>	<u>15.5</u>	<u>12.1</u>	<u>10.7</u>	<u>8.6</u>	<u>6.9</u>	<u>5.5</u>	<u>4.4</u>	<u>3.4</u>
- Large	10.6	8.3	7.7	7.1	5.0	4.8	4.5	2.9	2.8	2.7
- Medium	4.9	4.2	3.7	3.5	2.8	2.5	2.1	1.8	1.4	1.1
- Small	24.5	23.8	19.2	14.5	12.7	10.0	8.0	6.3	5.0	3.8
- Very Small	36.4	29.4	24.5	21.9	19.8	18.0	15.3	12.1	9.8	7.5
<u>Average Ann. Rental - Total</u>	<u>51.5</u>	<u>46.8</u>	<u>43.8</u>	<u>40.7</u>	<u>38.1</u>	<u>36.1</u>	<u>34.6</u>	<u>33.4</u>	<u>32.6</u>	<u>32.2</u>
- ARV \$12K up	<u>113.6</u>	<u>106.7</u>	<u>103.0</u>	<u>99.7</u>	<u>96.6</u>	<u>95.4</u>	<u>94.8</u>	<u>94.4</u>	<u>94.7</u>	<u>95.8</u>
- Large	1,125.7	1,182.0	1,241.1	1,303.1	1,368.3	1,436.7	1,508.5	1,583.9	1,663.1	1,746.3
- Medium	195.5	196.6	197.8	199.0	200.2	201.4	202.6	203.8	205.0	206.3
- Small	29.0	28.2	27.4	26.6	25.8	25.0	24.2	23.4	22.6	21.8
- Very Small	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0	9.0
<u>Annual Rental Value - Total</u>	<u>740</u>	<u>840</u>	<u>950</u>	<u>1,045</u>	<u>1,140</u>	<u>1,240</u>	<u>1,340</u>	<u>1,425</u>	<u>1,505</u>	<u>1,585</u>
- ARV \$12K up	<u>665</u>	<u>740</u>	<u>825</u>	<u>895</u>	<u>960</u>	<u>1,030</u>	<u>1,095</u>	<u>1,150</u>	<u>1,205</u>	<u>1,260</u>
- Large	270	305	350	390	430	475	520	560	605	655
- Medium	275	290	305	315	325	335	345	355	360	365
- Small	120	145	170	190	205	220	230	235	240	240
- Very Small	75	100	125	150	180	210	245	275	300	325

Table VI

TRENDS IN FEDERAL GOVERNMENT EDP COSTS AND STAFF, 1967-68 TO 1977-78

		67-68	68-69	69-70	70-71	71-72	72-73	73-74	74-75	75-76	76-77	77-78
A. Full EDP Costs		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Personnel		50.0	48.9	50.6	49.6	50.6	48.5	46.3	45.8	44.4	44.6	45.6
Salaries and wages*		43.5	42.5	44.0	43.1	44.0	42.2	40.5	39.7	38.6	38.7	39.6
Employee benefits*		6.5	6.4	6.6	6.5	6.6	5.8	6.1	5.8	5.8	5.9	6.0
Equipment		22.8	22.5	22.1	22.0	22.7	22.8	23.1	21.1	22.0	22.4	22.5
Equipment rent, actual*		22.8	22.5	22.1	22.0	21.6	21.6	16.7	15.5	16.5	16.7	16.7
Equipment rent, imputed												
Equipment maintenance												
Software acquisition		NA	NA	NA	NA	0.2	0.2	0.3	0.4	0.5	0.5	0.4
Purchased Computing Services		5.0	8.2	8.3	9.4	9.5	10.5	11.0	12.9	12.9	12.7	11.7
External facilities		4.0	5.3	6.5	7.3	7.6	8.0	8.0	9.6	10.0	9.3	8.5
EDP consultants & contract staff		1.0	2.9	1.8	2.1	1.9	2.5	3.0	3.3	2.9	3.4	3.2
Data Transmission ^(a)		0.2	0.2	0.2	0.2	0.3	1.2	1.8	2.0	2.7	2.8	2.6
Other Costs		22.0	20.2	18.8	18.8	16.9	17.0	17.8	18.2	18.0	17.5	17.6
Production supplies		5.5	4.4	3.8	3.7	2.6	2.2	3.2	3.3	3.2	3.3	3.3
Accommodation		NA	NA	NA	NA	NA	NA	4.4	4.0	4.3	4.1	4.1
Interest, imputed		1.6	1.5	1.5	1.5	1.6	1.5	1.4	1.5	1.5	1.4	1.4
Other		NA	NA	NA	NA	NA	NA	8.8	9.4	9.0	8.7	8.8
								%				
B. Staff Number		100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Managerial		NA	NA	NA	NA	3.6	4.1	4.6	4.8	5.4	5.2	5.1
Systems and programming		23.9	26.6	29.6	31.5	29.0**	30.4	29.8	29.4	29.8	30.0	31.3
Data conversion		NA	NA	NA	NA	31.7	30.4	30.3	31.7	30.9	32.0	30.8
Data production		NA	NA	NA	NA	35.7	35.1	19.3	14.5	15.7	16.8	16.8
Others												
								\$ '000				
C. Average Salary/Man. Year		5.5	6.1	7.1	7.6	8.0	9.1	9.7	11.1	12.0	13.0	14.1

Source: Treasury Board Secretariat - Review of EDP in the Government of Canada, 1974 and 1975-6 issues, Tables II and III.

NA: Not available.

* There may be a tendency for these items to be overestimated in forecasts (1975-76 to 1977-78).

(a) Believed to be under-reported.

** Comparability of data affected by inclusion of greater number of clerical staff in totals after 1970-71.

Table VII GOVERNMENT EDP COSTS AND OPERATING EXPENSES OF COMPUTER SERVICES FIRMS, 1974

EDP Cost Class/ Operating Expenses Class (if different)	1974-75		1974 Operating Expenses				
	Govt. EDP Costs	All CS Firms	Firms with \$500K- \$1,999K			Revenue of \$499K \$100K	
			% 100.0	% 100.0	% 100.0	% 100.0	% 100.0
<u>Full EDP Costs/Total Oper. Expenses</u>							
I. <u>Personnel</u>	45.8	43.8	40.0	48.6	51.0	48.1	
Salaries and wages	39.7	41.5	37.7	46.1	48.2	46.6	
Employee benefits	6.1	2.3	2.3	2.5	2.8	1.5	
II. <u>Equipment</u>	21.1	20.4	22.3	20.9	12.3	12.6	
Equipment rent, actual	15.5	14.3	15.7	14.5	9.8	11.0	
Equip. rent, imputed/Depreciation	3.6	4.0	4.5	3.7	1.7	0.4	
Equipment maintenance	1.6	1.5	1.7	1.4	0.5	0.7	
Software acquisition	0.4	0.6	0.4	1.3	0.3	0.5	
III. <u>Purchased Computing Services</u>	12.9	6.2	5.3	4.3	10.8	13.9	
External facilities	9.6	5.2	3.9	4.1	10.6	10.9	
EDP consultants & contract staff	3.3	1.0	1.4	0.2	0.2	3.0	
IV. <u>Data Transmission/Communications</u> ²	2.0	3.9	5.3	1.6	1.6	1.8	
V. <u>Other Costs</u>	18.2	25.7	27.1	24.6	24.3	23.6	
Prod. supplies/Purch. for business ³	3.3	4.3	4.0	4.3	5.2	4.1	
.../Purchases for resale	-	2.8	2.7	3.2	3.2	0.5	
Office supplies, stationery ³	1.1	-	-	-	-	-	
Accommodation	4.0	4.7	4.7	5.4	4.2	4.4	
Travel	0.6	2.3	2.6	1.9	2.2	3.0	
Interest, imputed/Int.& bank	1.5	1.7	2.1	1.1	1.2	1.2	
Telephone, telegraph ²	0.4	-	-	-	-	-	
Departmental costs	6.5	-	-	-	-	-	
.../Rent for vehicles, other equip.	-	0.4	0.2	0.3	0.8	1.6	
.../Purchased delivery	-	0.5	0.5	0.7	0.5	0.4	
.../Amortization of R&D	-	0.9	1.1	0.8	0.4	0.2	
.../Purchased advertising	-	0.5	0.7	0.5	0.5	0.9	
Government costs	0.7	-	-	-	-	-	
.../Taxes, permits & licenses	-	0.5	0.6	0.4	0.3	0.5	
.../Insurance	-	0.3	0.3	0.2	0.3	0.4	
.../Purchased legal, audit, other professional services	-	1.4	1.3	1.2	1.7	2.4	
Language training ⁴	(0.9)	-	-	-	-	-	
Other expenses	1.0	5.4	6.3	4.6	3.8	4.0	

Sources: Treasury Board, "Review of EDP, 1975-76", and Statistics Canada, "Computer Service Industry, 1974", and correspondence.

1. Includes purchased and leased software packages.
2. In 1974, Statistics Canada included in "Communications" regular telephone, telegraph, telex and postage charges. In 1975 it is planned to show "Data Communications" separately.
3. The Statistics Canada total "Purchases for use in the business" probably includes "Office supplies and stationery".
4. A deduction from EDP costs of amounts identified as supporting the official languages policy rather than the provision of EDP services.

Table VIII

USER COST AND SUPPLIER REVENUE DISTRIBUTIONS USED WITH MODEL, 1974

Computing User Costs				Computing Services Supplier Revenues				Hardware Supplier Revenues			
Govt. EDP Costs	C.S. Supplier Costs	Assumed User Costs	As Reported	\$	As Used	As Reported	As Used	%	%	%	%
<u>Total Costs or Revenues</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
<u>Personnel</u>	<u>45.8</u>	<u>43.8</u>	<u>44.0</u>	<u>41.9</u>	<u>42.0</u>	<u>39.7</u>	<u>25.1</u>	<u>25.0</u>	<u>22.8</u>	<u>2.3</u>	<u>2.3</u>
<u>Salaries and wages</u>	<u>39.7</u>	<u>41.5</u>	<u>2.3</u>	<u>2.2</u>	<u>2.2</u>	<u>2.2</u>	<u>2.2</u>	<u>2.2</u>	<u>2.2</u>	<u>2.3</u>	<u>2.3</u>
<u>Employee benefits</u>	<u>6.1</u>	<u>6.1</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>Computing Equipment</u>	<u>21.1</u>	<u>20.4</u>	<u>21.0</u>	<u>19.5</u>	<u>20.0</u>	<u>34.7</u>	<u>35.0</u>	<u>35.0</u>	<u>18.8</u>	<u>18.8</u>	<u>18.8</u>
<u>Purchased for resale</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Depreciation on owned equipment	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
- rented to others	<u>3.6</u>	<u>4.0</u>	<u>3.8</u>	<u>3.8</u>	<u>3.8</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
- used by respondent	<u>15.5</u>	<u>14.3</u>	<u>14.3</u>	<u>13.7</u>	<u>13.7</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Rented from others	<u>1.6</u>	<u>1.5</u>	<u>1.5</u>	<u>1.4</u>	<u>1.4</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Maintenance by others	<u>0.4</u>	<u>0.6</u>	<u>0.6</u>	<u>0.6</u>	<u>0.6</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Software acquired separately	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>Purchased Computing Services</u>	<u>12.9</u>	<u>6.2</u>	<u>14.0</u>	<u>6.0</u>	<u>6.0</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>External facilities</u>	<u>9.6</u>	<u>5.2</u>	<u>—</u>	<u>5.0</u>	<u>5.0</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
EDP consultants & contract staff	<u>3.3</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>1.0</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>Data Transmission</u>	<u>2.0</u>	<u>3.9</u>	<u>4.0</u>	<u>3.7</u>	<u>4.0</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>Other Costs</u>	<u>18.2</u>	<u>25.7</u>	<u>7.1</u>	<u>24.7</u>	<u>24.0</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>Production supplies</u>	<u>4.4</u>	<u>4.7</u>	<u>4.7</u>	<u>6.8</u>	<u>6.8</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Accommodation	<u>4.0</u>	<u>4.7</u>	<u>4.7</u>	<u>4.5</u>	<u>4.5</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Interest and bank charges	<u>1.5</u>	<u>1.7</u>	<u>1.7</u>	<u>1.6</u>	<u>1.6</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
Other	<u>8.3</u>	<u>12.2</u>	<u>12.2</u>	<u>11.8</u>	<u>11.8</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>—</u>
<u>Operating Profit (before taxes)</u>	<u>—</u>	<u>—</u>	<u>—</u>	<u>4.2</u>	<u>4.0</u>	<u>23.9</u>	<u>24.0</u>	<u>24.0</u>	<u>—</u>	<u>—</u>	<u>—</u>

Sources: As Table VII. Assumed User Costs estimated by C/CS.

1. Federal government spending on purchased computer services assumed to be below average because of the above average size of its operations. The model shows inconsistent results with a figure appreciably larger or smaller than 14%.

2. Not reported separately. Assumed to be less than 0.5%.

3. The federal government is believed to undercount this cost; supplier data assumed to be more representative.

4. Most users would not incur certain government EDP overheads, nor certain supplier expenses (production supplies for resale, marketing costs, etc.).

Table IX

USER COST, SUPPLIER REVENUE AND EQUIPMENT
MARKET DISTRIBUTIONS USED IN FORECAST,
1970-1985

	1970 %	1974 %	1975 %	1980 %	1985 %
<u>Total User Costs</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
1. Personnel	46.0	44.0	44.0	42.0	41.0
2. Computing equipment	23.0	21.0	21.0	19.0	17.0
3. Purchased computing services	12.0	14.0	15.0	18.0	20.0
4. Data transmission	2.0	4.0	4.0	6.0	8.0
5. Other costs	17.0	17.0	16.0	15.0	14.0
<u>Total Computing Services Revenues</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
1. Personnel	44.0	42.0	42.0	40.0	39.0
2. Computing equipment	25.0	20.0	20.0	17.0	15.0
3. Purchased computing services	4.0	6.0	6.0	7.0	8.0
4. Data transmission	4.0	4.0	4.0	6.0	8.0
5. Other costs	28.0	24.0	23.0	20.0	18.0
6. Profit	(5.0)	4.0	5.0	10.0	12.0
	\$'000,000				
<u>Total Computing Hardware Revenues</u>	<u>340</u>	<u>605</u>	<u>725</u>	<u>1,300</u>	<u>1,865</u>
1. From C/C users	260	465	555	985	1,400
2. From computing service suppliers	35	65	85	170	270
3. From other hardware suppliers	15	30	35	75	125
4. From data transmission suppliers	5	10	10	20	25
5. Revenue/cost excess	25	35	40	50	45
	%	%	%	%	%
<u>Total Computing Hardware Revenues</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>	<u>100.0</u>
1. From C/C users	76.5	76.9	76.6	75.8	75.1
2. From computing service suppliers	10.3	10.7	11.7	13.1	14.5
3. From other hardware suppliers	4.4	5.0	4.8	5.8	6.7
4. From data transmission suppliers	1.5	1.6	1.4	1.5	1.3
5. Revenue/cost excess	7.3	5.8	5.5	3.8	2.4

Source: Estimates by C/CS, except for 1974 Computing Services Revenue distribution (Statistics Canada).

Table X

ESTIMATES OF COMPUTER/COMMUNICATIONS IN CANADA, 1970-1985

	1970	1974	1975	1980	1985
\$'000,000					
<u>Costs Incurred by Users</u>	1,130	2,215	2,640	5,185	8,235
Personnel	520	975	1,160	2,180	3,375
Computing equipment	260	465	555	985	1,400
Purchased computing services	135	310	400	930	1,655
Data transmission	25	90	105	310	655
Other costs	190	375	420	780	1,150
<u>Computing Services Revenues</u>	140	330	425	1,000	1,800
Personnel	60	135	180	400	700
Computing equipment	35	65	85	170	270
Purchased computing services	5	20	25	70	145
Data transmission	5	15	15	60	145
Other costs	40	80	100	200	325
Profit	(5)	15	20	100	215
<u>Computing Hardware Revenues*</u>	340	605	725	1,300	1,865
Personnel	85	150	180	325	465
Computing equipment	120	210	255	455	655
Other costs	55	95	115	210	300
Profit	80	150	175	310	445
<u>Data Transmission Revenues</u>	30	105	120	370	800
<u>Total Personnel Costs</u>	665	1,260	1,520	2,905	4,540
User C/C personnel	520	975	1,160	2,180	3,375
Computing services personnel	60	135	180	400	700
Hardware personnel	85	150	180	325	465
% of Total User Costs					
<u>Total Personnel Costs</u>	58.8	56.9	57.6	56.0	55.1
User C/C personnel	46.0	44.0	44.0	42.0	41.0
Computing services personnel	5.3	6.1	6.8	7.7	8.5
Hardware personnel	7.5	6.8	6.8	6.3	5.6
Computing Services Revenues	12.4	14.9	16.1	19.3	21.9
Computing Hardware Revenues	30.1	27.3	27.5	25.1	22.6
Data Transmission Revenues	2.7	4.7	4.5	7.1	9.7

Source: Estimates by C/CS.

* Based on percentages in Table VIII. For distribution of revenues by source see Table IX.

DRAFT FOR DISCUSSION

ANALYSIS OF COMPUTER/COMMUNICATIONS BUDGETS REPORTED
IN DATACOM '76 SURVEY

(A supplement to The Growth of Computer/Communications in Canada)
(Supp #1)

DEPARTMENT OF COMPUTER SCIENCE
MCLENNAN LABORATORY
UNIVERSITY OF TORONTO

Computer/Communications Secretariat
July 1977

AUG 8 1977

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ANALYSIS OF COMPUTER/COMMUNICATIONS BUDGETS
REPORTED IN DATACOM '76 SURVEY¹

I. INTRODUCTION

When the Computer/Communications Secretariat prepared its draft paper on "The Growth of Computer/Communications in Canada", there was little information on how user costs for computer/communications are distributed. A principal objective of that paper was to develop estimates of the size and distribution of user costs in the absence of actual statistics.

At the same time as the Secretariat's estimates were being developed, the Communications Research Centre of the Department of Communications was preparing to conduct the DATACOM '76 survey. Its principal purpose was to obtain information on future requirements for data communications facilities and services, but some budget information was required as a basis for analysis of the results. Arrangements were made to ensure that this budget information would include the principal distinctions required by the Secretariat's model.

The survey was conducted during the summer and autumn of 1976, and the contractor's² initial analysis of the data was completed in December. Seventy-four firms completed the DATACOM '76 questionnaire, and the replies to questions I.A.6 and I.A.7 were made available to the Secretariat in January 1977 (see Appendix A for the text of these questions). Because of the need to maintain confidentiality and protect the identity of the respondents, the data were provided to the Secretariat without respondent identification. They were, however, classified into six "industry" groups.

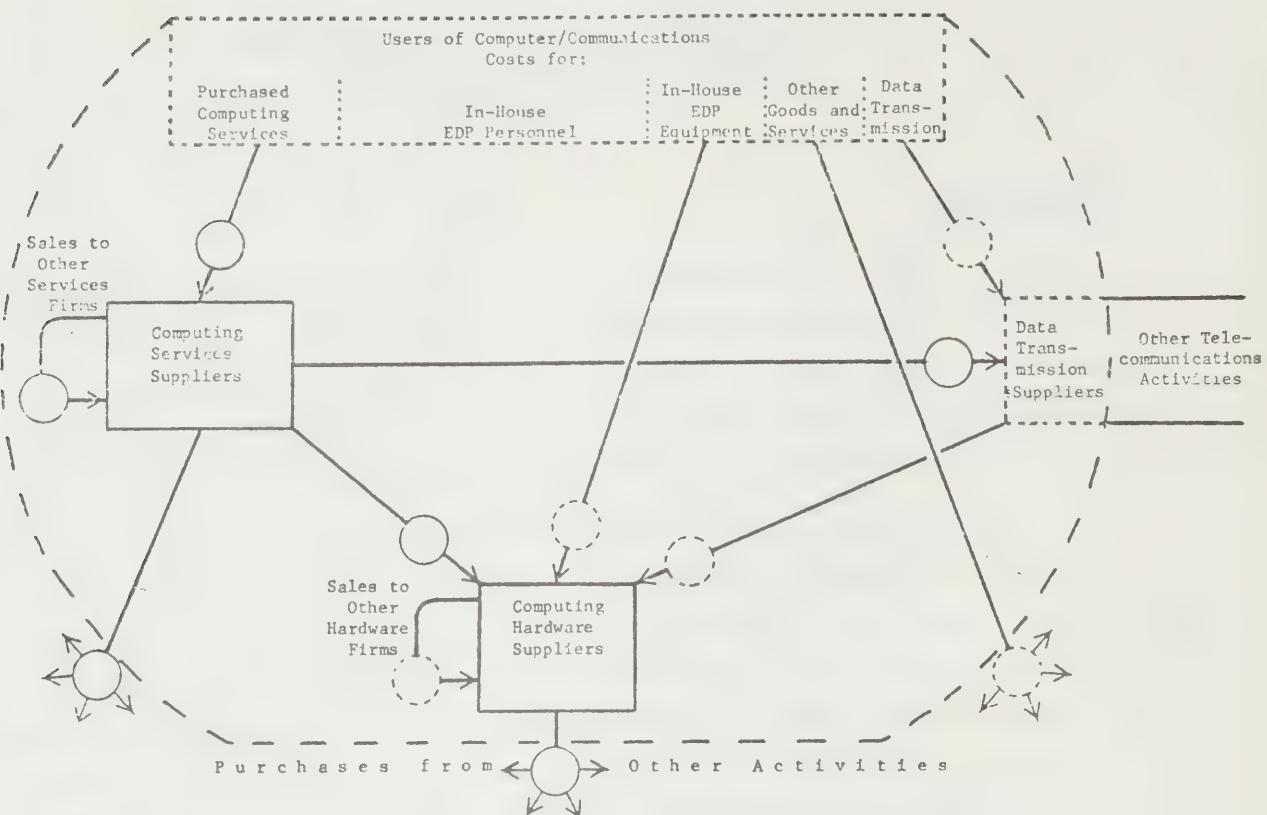
The principal objectives of the Secretariat's analysis were to check the data carefully for likely reporting errors, to compile some details not required in the initial DATACOM analysis, and to determine the extent to which these data confirmed or contradicted the assumptions regarding user expenditure made in "The Growth of Computer/Communications in Canada". The present paper provides an account of our findings, with (we hope) sufficient data to permit others to appraise our conclusions. The DATACOM '76 responses cannot be made generally available.

1. CRC Report No. 1306, Department of Communications, April 1977.

2. Price, Waterhouse Associates, in collaboration with Mr. Roger W. Hough.

Chart I.

A MODEL OF COMPUTER/COMMUNICATIONS ACTIVITIES IN CANADA



To aid in following this analysis, Chart I from "The Growth of Computer/Communications in Canada" is reproduced above. The analysis focuses on users, who require computer/communications goods or services as a tool to accomplish some other purpose, rather than on suppliers, who produce computer/communications services or goods for sale.

The survey shows that large experienced users are still increasing their computer/communications budgets by some 15% per year. The overall budget patterns of commercial users resemble those of federal government departments and service bureaus. Personnel is usually the largest cost element, equipment cost a distant second. A rising proportion of user budgets is earmarked for in-house data communications equipment (terminals, modems, multiplexors, etc.) which more than offsets the declining proportion spent on computing equipment.

The analysis also identifies variations in the relative importance of particular cost classes among users in different industries, and between users of in-house and service bureau facilities. Commercial firms generally appear to direct a smaller part of their budgets to the purchase of commercial computing services than do federal departments and agencies.

II. DIFFERENCES EXPECTED

Three obvious differences were expected between the DATACOM '76 budget information and the concepts incorporated in the Secretariat's model of computer/communications. These arose from the nature of the DATACOM sample, the type of expenditure information collected, and the comparability of information relating to "service bureaus" with information relating to "purchased computing services". Some random reporting errors were also expected.

The DATACOM sample concentrated on firms which were believed to be on the "leading edge" of computer/communications use in Canada. In general, these were very large and very experienced users. In general, they were concentrated in certain industry areas and in central Canada, although a deliberate effort was made to ensure some regional representation. The sample was not selected to be representative of all users or to produce indicators of average use or expenditure. The Secretariat's model, on the other hand, is intended to represent total use. This analysis therefore attempts to identify and offset any biases inherent in the DATACOM sample.

The DATACOM survey asked for information on the corporate data processing and data communications budget, while the Secretariat's model deals with cost allocations. The principal conceptual difference between budget and cost information is in the treatment of newly purchased or already owned equipment; DATACOM recognized the limitations of the budget concept by informing respondents that "Purchased equipment should be converted to rental equivalent using 1/40th of purchase price." This is likely to yield a higher figure for owned equipment than would the use of actual depreciation allowances plus maintenance and the discounted cost of capital, especially if the depreciation allowances are in line with the capital cost allowance provisions of the Income Tax Act.

The pre-1976 income tax law permitted a capital cost (depreciation) allowance of 20% on computing equipment, on the basis of residual value. At this rate it took 10 years to reduce the residual value of a computer to about 11% of its original price, whereas the 1/40th basis reduces the value to zero in less than $3\frac{1}{2}$ years. With the change to a 30% diminishing balance in the 1976 income tax amendments, it still takes 6 years to reach a 12% residual value (and about 8 years to reach the point at which capital cost, maintenance, and interest charges are fully offset by rental savings). The DATACOM procedure would result in much higher values for owned equipment than would the use of

tax-related depreciation. It would also yield higher figures than the techniques used in compiling information on federal government EDP costs.

The third conceptual difference is that DATACOM asked for information on "service bureau expenditures". The term "service bureau" is usually applied to firms which provide machine-based computing services, and is not usually extended to include suppliers of such other computing services as consulting, systems and programming work, and training activities. The Secretariat's model deals with expenditure on all computing services.

It was also expected that the reported budget data might not always be consistent. All firms do not formulate budgets in the same way, nor allocate the same costs to their components. And these differences seemed likely to be reflected in the data reported, especially since the detail requested was limited and the survey form therefore could not be used as a checklist. Misinterpretations of requests for information are also most likely the first time a survey is conducted.

The analysis confirmed these conceptual differences and revealed reporting errors of various types. However, neither the random errors nor the impact of conceptual differences appear to make the DATACOM information unsuitable for use or even difficult to use. On the contrary, the value of this information appears comparable to that of the improved cost distributions in the 1974 Computer Service Industry report, which were basic to the construction of the Secretariat's model.

III. OUTLINE OF THE ANALYSIS

The first review of the information was performed within the framework of the six industry groups which were used to present budget and related data in the DATACOM '76 report.¹ Not all firms in the survey sample responded to Question I.A.6. The distribution of responses by industry group was as follows:

	Survey Sample	Responses to Question I.A.6.		
		Total	All Years	Some Years
<u>User Industries</u>				
1. Finance	21	19	11	8
2. Transportation and Utilities	10	9	4	5
3. Resource	6	6	4	2
4. Wholesale, Retail and Other	9	9	8	1
5. Manufacturing	17	14	11	3
Total Users	63	57	38	19
<u>Supplier Industry</u>				
6. Service Bureaus	11	8	7	1
Totals	74	65	45	20
% of Responses	100%	88%	61%	27%

A number of minor reporting errors and gaps in individual responses were detected during this review. These were corrected in various ways as seemed appropriate to the particular case. Where imputation was necessary it was based either on the pattern of the same firm in other years or on the average of other members of the same industry group. The extent of editing was as follows:

	Total Responses	No Edits Needed	Addition Corrections	Some Imputations
Available for All Years	45	32	8	5
Available only for Some Years	20	12	2	6

Note the much higher proportion of imputations needed in the case of firms who did not provide data for all three years.

At the close of this review, the industry totals were compared with those compiled by the contractor for the DATACOM '76 report. Except in two groups, where additional responses were received after the contractor completed the initial tabulations, the results were substantially identical in spite of all

1. Op. cit., especially pp. 4-11.

corrections and edits being performed independently. However the tables of this paper provide a more detailed breakdown of these data than was required for DATACOM '76, and one which is more comparable with the tables in "The Growth of Computer/Communications in Canada".

At this and subsequent stages of the analysis, separate tables were compiled for firms reporting in all years, and for all firms reporting in any year. Both sets of values cannot be presented by industry group without disclosing the information submitted by some individual firms. The rule followed is therefore to present value details only for the firms reporting in all years, and to present only percentage distributions for the broader group. Tables 1-3 present the data on this basis, without further adjustments. Tables 5-7, which exclude a few returns to improve comparability, also combine the groups for Transportation and Utilities and Resource to avoid the danger of disclosure.

When DATACOM '76 was being designed, it was assumed that different industry groups might well have different data communications needs. The sample was therefore selected to ensure some representation of potentially different industries. However, in reviewing the user industry groups it was noticed that a few reports in each group departed widely from the group pattern, and that these departures themselves fitted into one of two patterns. One pattern was characterized by the allocation of more of the budget to service bureau use than to in-house computing equipment; such firms were identified as "chiefly service bureau users". The other pattern was characterized by heavy expenditure on in-house equipment (usually over 50% of budget, and never less than 45%), and relatively small expenditures on personnel (usually under 20% of budget, and reaching 30% in the case of a single firm which identified its report as relating only to specific aspects of its data processing expenditures). These firms appear to have omitted the cost of systems and programming staff from their reports, and were therefore identified as "data processing operations only". Values and distributions for these two user groups, and for the remaining users (identified as "chiefly in-house") appear in Table 4.

The data processing operations reports are interesting in themselves, but clearly do not belong in a study of total user budgets for computer/communications. They were therefore eliminated from the industry groups for analysis; the revised groups appear in Tables 5-7.

Another problem revealed by data inspection was that about one-third of the respondents reported "other" costs amounting to less than 10% of their

budgets. Most of these respondents were among the smaller users, which reduced the impact of these probable reporting errors on totals. No corrections were therefore applied.

Certain information was identified during the analysis as less suitable for use with the Secretariat's model of computer/communications than information from another source, or as completely unusable. This was the information for the service bureau industry group, and the information supplied in response to question I.A.7.

The model, which was largely based on Statistics Canada's Computer Service Industry report, distinguishes a group of Computing Service Suppliers. This group includes service bureaus, but also includes suppliers of other services. Respective revenues for 1974 and 1975 were approximately as follows:

<u>Source of Revenue</u>	<u>1974</u> \$'000,000	<u>1975</u>	<u>1974</u> %	<u>1975</u> %
Computer processing	204.1	255.1	64.1	67.0
Input preparation	21.3	26.4	6.7	6.9
Software	71.9	80.4	22.6	21.1
Education and other	21.1	19.0	6.6	5.0
	318.4	380.9	100.0	100.0

(Values estimated by C/CS from Statistics Canada reports)

All service bureaus covered in the DATACOM survey are known to derive the bulk of their revenue from computer processing. Their costs are therefore not truly representative of the model's computing services activity. And Statistics Canada provides a quite detailed cost breakdown for the computer services industry which is almost certainly more representative of all computing services suppliers. Table 2 shows, in part B, the cost distribution of service bureaus as reported to DATACOM, and in part C the costs of computer services industry firms as reported by Statistics Canada for firms with revenues of \$2 million or more. The DATACOM information is based on returns from only 7 firms, and the differences between the two distributions are less than the average differences within the DATACOM group.

There were also a few reporting anomalies within the DATACOM group which strengthen the preference for the Statistics Canada series. One service bureau reported no budget either for computer equipment or for services from another bureau. A second showed improbably low equipment expenditure, a third improbably high equipment expenditure. All three cases almost certainly

reflect failure to follow the 1/40th (monthly) rule as suggested in the DATACOM instructions.

The responses to question I.A.7 followed no meaningful pattern, perhaps because of a slip-up in questionnaire editing. The question itself asked about "Total telecommunications budget (equipment and transmission)", and in some cases the value calculated from part (b) was approximately equal to the sum of data communications equipment and data transmission costs as calculated from I.A.6. The reference information for the question asked for "payments to carriers, excluding carrier-provided modems, multiplexors, terminals and other equipment", and in some cases the information provided was roughly equivalent to the data transmission costs reported in I.A.6. However, in many cases, no relationship was apparent between I.A.6 information and I.A.7 information. Because of this inconsistency, the attempt to use information from question I.A.7 was abandoned.

IV. FINDINGS OF THE ANALYSIS

1. Coverage of the Sample

Although the DATACOM '76 survey obtained information from only 74 firms, the budgets reported for 1976 amounted to 15.9% of the Secretariat's estimate of total user costs for that year. Even when the supplier budgets (service bureaus) and partial budgets (data processing operations only) are eliminated, the remaining 56 budgets accounted for 13.0% of estimated total user costs in 1976.

Prior to DATACOM '76, the only group of users for which spending patterns had been published was the departments and agencies of the federal government. These covered about 9.4% of estimated total user costs in 1976. DATACOM thus more than doubled our direct knowledge of user spending patterns in 1976. It also provided information on non-government use (which is the greater part of the user universe).

The year-to-year variations in the direct coverage of user spending are shown below. DATACOM's coverage was greatly reduced for 1977, but still amounted to 7% of estimated total user costs.

	<u>1975</u>	<u>\$'000,000</u>	<u>1976</u>	<u>1977</u>	<u>1975</u> %	<u>1976</u> %	<u>1977</u> %
1. Estimated user costs for computer/communications	2,640.0	3,000.0	3,600.0	100.0	100.0	100.0	100.0
2. Federal government costs	244.6	283.3	323.1	9.2	9.4	9.0	9.0
3. DATACOM - all budgets reported	412.7	477.8	355.6	15.6	15.9	9.9	9.9
4. - User full budgets only	337.8	390.7	251.4	12.8	13.0	7.0	7.0
5. - Users who reported full budgets for every year	192.2	222.7	251.4	7.3	7.4	7.0	7.0
6. Direct coverage of user costs (lines 2 & 4)	582.4	674.0	574.4	22.1	22.5	16.0	

2. Trends Suggested

A three-year period is a very inadequate basis for establishing whether trends exist or have changed. And in using the DATACOM figures to assess trends it is important to avoid distortion due to sample changes from year to year

(cf. lines 4 and 5 in the preceding statement). The following comments on trends are based primarily on Tables 5 and 6, with Table 7 taken into account only to the extent that it suggests that a broader sample would show higher or lower percentages than the 33 firms reporting in all years.

The most obvious trend is a continued rapid growth in computer/communications spending even among these large and experienced users. The average user budget reported for 1975 was \$5.8 million; it increased by 16% to \$6.7 million in 1976 and by a further 13% to \$7.6 million in 1977. All industry groups increased their computer/communications budgets in this period, but the rates differed from industry to industry as indicated by the following statement:

	<u>Increase in Budgets from</u>		
	<u>1975-1976</u> %	<u>1976-1977</u> %	<u>1975-1977</u> %
Wholesale, Retail, Other	24.2	19.0	47.8
Finance	17.6	15.7	36.0
Manufacturing	12.5	11.5	25.5
Transport, Utilities, Resource	<u>12.7</u>	<u>8.0</u>	<u>21.8</u>
Total, 33-firm sample	15.9	12.9	30.8
Total, all usable reports	15.6	--	--

These relative growth rates appear quite consistent with what other information is available about current developments in industry automation.

Little weight should be given to the differences in percentages for 1975-76 and 1976-77. Experience with government forecasts of computing needs suggests that the next year's accomplishments are usually overestimated, the work which will remain for the following year usually underestimated! There is as yet no reason to assume that this tendency would be avoided in commercial forecasts of computing needs.

These growth rates appear reasonably compatible with the average growth of 14% per annum forecast by the Secretariat for 1975-80, especially since computing growth tends to be faster among smaller users. This can be illustrated by reference to the federal government data presented in Table 8. The five largest EDP users show a 21% increase in forecast costs from 1975-76 to 1977-78. The rate of increase rises steadily through successive groups to 39% for the 16th-20th ranking users and 65% for the 25 smaller users. DATACOM size groupings (Table 9) do not show as regular a pattern (perhaps because of the concentration on large experienced users in each industry group), but appear to confirm that the rate of growth is likely to be greatest among smaller firms.

Table 6 appears to support the Secretariat's assumptions that personnel and "other" costs would absorb a decreasing proportion of the user dollar, and that spending on purchased services would increase in importance. However the uptrend in in-house equipment budgets contradicts another Secretariat assumption. Computer equipment does appear to have a falling budget share, but this is more than offset by rising spending on data communications equipment.

The budget proportions earmarked for data communications equipment are both larger than would have been assumed last year and are increasing steadily. However, the information on actual and planned terminal installations published in the DATACOM '76 report (page 31) indicates some tendency for average data communications equipment expenditure per terminal to rise in industries where the rate of increase in terminal numbers is accelerating, and to fall where the rate of increase is slowing. This tendency is consistent with the hypothesis that some purchased terminals were reported to DATACOM on the basis of purchase cost and in the year of purchase only, a hypothesis that is supported by the year-to-year variations in data communications equipment spending reported by a few firms. The correction of these likely reporting errors might stabilize total in-house equipment expenditure, but would more likely leave it increasing slightly.

3. Patterns of Budget Distribution

Tables 6 and 7 illustrate the distribution of budgets in the four user industries, the first for the 33-firm sample, the second for all usable reports. The more broadly based figures for 1975 and 1976 that appear in Table 7 are probably the better guide to levels, the identically-based figures of Table 6 to any meaningful changes in pattern. The figures in Table 6 are followed by a "+" or "-" sign whenever comparison with Table 7 suggests that an adjustment in level might be appropriate.

Certain differences in industry budget patterns are clearly illustrated by Table 6. Finance shows the smallest proportion for in-house staff and the largest proportion for in-house equipment, especially data communications equipment (the rise in the data communications equipment proportion is so rapid that it strongly suggests inclusion of at least some measure of capital expenditure). The Transportation, Utilities and Resource group follows Finance in these respects, and shows the highest budget percentage for data transmission. These features, while still significant, are much less pronounced than suggested in Tables 2 and 3, where they were exaggerated by the concentration of partial data processing operations returns in these industry groups.

The Manufacturing and Wholesale, Retail and Other groups show about the same budget proportions for personnel, when allowance is made for the differences between Tables 6 and 7. Both proportions are significantly higher than the corresponding figures for the federal government (see Table 10)! The Manufacturing group spends a smaller proportion of its budget on in-house computer equipment and on data transmission than the other industry groups. Wholesale, Retail and Other, rather unexpectedly, shows the lowest proportion for data communications equipment (which includes terminals in this survey).

Although the budget patterns of individual firms within each industry group are fairly consistent in many respects, the small number of firms in each group requires some caution in use of these patterns. For example, in the Transportation, Utilities and Resource group, the high data transmission percentage is heavily influenced by one large firm. This suggests that the differences in industry patterns may not always be meaningful, or might not be so prominent if a larger sample were available.

The similarities and differences between the "chiefly in-house" user and the "chiefly service bureau" user shown in Table 4 should be noted carefully; they are important to the proper application of DATACOM sample results to the user universe. Both devoted about the same proportion of budget to personnel, data communications equipment and data transmission. The service bureau user shows significantly higher budget proportions for service bureaus and software, and significantly lower proportions for computer equipment and "other" costs. The service bureau user shows a much smaller average budget (for 1976, \$1.3 million versus an average in-house budget of \$8.0 million). The service bureau user also expected greater budget stability; he expected an average 21% increase in expenditures from 1975 to 1977, compared with a 31% increase for in-house users.

A noteworthy development, which is not illustrated in Table 4, is that two of the larger users in the sample, who belonged in the in-house group in 1975 and are therefore classified in that group in all three years, had in fact migrated to the chiefly service bureau group by 1977. These two firms do not show the very low "other" and above-average "software" percentages characteristic of the smaller service bureau user, and one of the two (who also increased his in-house computer equipment budget in the period) did not even show the below-average budget increase which was characteristic of most service bureau users.

Also worth noting is that users covered by DATACOM '76 planned to increase their spending at service bureaus more rapidly than the service bureaus planned to increase their own spending. Table 1 shows that user expenditure at service bureaus was projected to rise almost 28% from 1975 to 1976, while service bureau budgets show an increase of only 13%. For 1976 to 1977 the respective increases are 16% and 12%.

4. Reweighted Average of Industry Patterns

The existence of different budget patterns in the different industry groups, together with the known bias in sample selection, creates doubt as to whether a distribution pattern based on summing the values reported to DATACOM provides the most meaningful average pattern for these users. An obvious alternative was to take a weighted average of the industry patterns using weights based on the installed value of computers in each industry calculated from the CIPS Census,

The weights were calculated in two steps. First, the DATACOM sample values for total in-house equipment were compared with the estimated rental value of the computer equipment reported for a comparable "industry" in the CIPS Census (in this comparison, the CIPS industries "Transport", "Utilities" and "Petroleum" were totalled for comparison with "Transportation, Utilities and Resource"). Second, the budget totals for the DATACOM groups were multiplied by the ratio of the CIPS equipment total to the DATACOM equipment budget. The relative size of the budget totals for these four industries according to the DATACOM sample and according to the data when reweighted by the CIPS Census figures are as follows:

Table 6 Sample		Table 7 Sample	
DATACOM	CIPS	DATACOM	CIPS
Weight	Weight	Weight	Weight

1975

Finance	23.7	22.0	35.5	20.9
Transport, Utilities, Resource	31.5	30.9	35.9	27.5
Wholesale, Retail, Other	17.9	12.9	10.7	13.0
Manufacturing	26.9	34.2	17.9	38.6
Total	100.0	100.0	100.0	100.0

1976

Finance	24.0	21.2	36.9	20.2
Transport, Utilities, Resource	30.7	30.2	34.1	26.2
Wholesale, Retail, Other	19.2	14.5	11.5	14.9
Manufacturing	26.1	34.1	17.5	38.7
Total	100.0	100.0	100.0	100.0

The DATACOM sample clearly underweights manufacturing. The Table 6 (33-firm) version happens to eliminate most of the Table 7 (48 firm) over-weighting of Finance and Transportation, Utilities and Resource, but substitutes an overweighting of the Wholesale, Retail and Other group. The industry distributions were therefore combined using CIPS weights; the results are shown in Tables 6 and 7. Because no CIPS census is available for 1977, the 1977 line was estimated on the basis of the amount of revision to the original distributions resulting from the reweighting of 1975 and 1976.

In general, the reweighted totals in these two tables (part 6 of each table) compare somewhat more closely with each other than did the original totals (part 5 of each table). Some of the distribution trends suggested by Table 6 have been softened by the reweighting (even the reweighted figures of Table 7 should not be interpreted as suggesting trends, especially to the extent that they change from 1976 to 1977). Most of the correction factors suggested by the comparison of Tables 6 and 7 would further reduce the evidence of apparent trends in this short period.

V. THE USE OF EXTERNAL SERVICES

The most striking difference between the reweighted user budget distributions in Tables 6 and 7 and the assumptions made in "The Growth of Computer/Communications in Canada" is in the allocation for external services (the Secretariat's original estimates appear in Table 10). In general, the DATACOM figures are about half as great, ranging from 6% to 9% as opposed to Secretariat assumptions of 15% and 16%.

For several reasons, this discrepancy is considered to reflect more the bias of the DATACOM sample than an error in the original assumptions. In the first place there is a high probability that DATACOM did not report consulting, systems and programming, and training expenditures in its "service bureaus" total. Statistics Canada data suggest that these account for one-quarter of all computing services revenues, and Treasury Board reports them as accounting for about the same proportion of federal government expenditures for external computing services.

A second reason for doubt is suggested by considering the effect of using a figure in the 6% to 9% range in model-based calculations. It would, on the basis of Statistics Canada's data on commercial sales of computing services, imply total user expenditure of some \$5 billion in 1975, and this would, in turn, imply user equipment costs of some \$1.25 billion. Neither Statistics Canada data nor the CIPS Census would appear to support user equipment costs in excess of \$0.7 billion for 1975.

Most important is the relationship between the size of total user EDP costs and the proportion of user spending on external services which was revealed by federal government statistics and is presented in Table 8. The greater the total costs of any user, the smaller a proportion is likely to be directed to external services. This is largely a matter of economies of scale. A large user, or a large service bureau, can afford a variety of in-house expertise and equipment, and can usually attain an efficient level of use of most skills and equipment. A smaller user or service bureau will usually find it necessary to specialize, and to purchase a large share of his requirements for other specialized knowledge and services from other specialist suppliers.

This pattern is not equally clear in the DATACOM sample. However, it must be remembered that this sample consists almost entirely of large users. It must also be borne in mind that two of the five largest users in the sample were transferring from the "primarily in-house" to the "primarily service bureau"

group in this period (these transfers suggest that factors other than mere economies of scale could play a significant part in the decision to use external services). If these firms are omitted, the service bureau percentages for the top group drop to 4.5%, 4.2% and 3.8%, a level and trend much more in line with the pattern revealed by federal government data. Even without this adjustment the very high service bureau use by the smallest firms in the DATACOM sample is obvious.

The greater regularity in the federal government of the association between total costs or budgets and the proportion directed to external services probably arises in part from a lesser diversity of EDP uses in government than exists in industry. In part it may also reflect the pressure of federal administrative policy which, since 1971, has attempted to ensure that services are purchased from the private sector unless it is clearly more economical to produce these services in-house. The percentage of federal government costs incurred for the purchase of external services tends to be considerably higher, at any level of total costs or budget, than is shown by the DATACOM '76 sample.

Table 9 also presents a very simple residual calculation of the level of use of outside services by all users not included in the DATACOM sample or represented by federal government use. The calculation assumes that provincial and municipal spending on computer/communications is roughly equal to federal spending, and follows the federal pattern. The assumption as to the amount of provincial and municipal spending on computer/communications is supported by market data in the Statistics Canada report on the Computer Services Industry, but the assumption as to the proportion of service bureau spending is probably conservative, in view of the smaller average size of provincial and municipal spending units, and of the known practice of some provincial governments. The calculations also assume that the Secretariat's estimates of total user spending on computer/communications are roughly accurate. Deduction of the DATACOM sample total and the "all governments" estimate from the estimate of total user spending yields an estimate for other non-government users.

This residual estimate for service bureau spending is 16%-18% of the residual estimate of total spending, a lower ratio than applies to the smallest firms in the DATACOM sample. The residual group would have to include at least 1,500 users for average expenditure per user to be low enough to be consistent with this ratio; in fact, for 1975 the CIPS Census identified some 3,000 users in Canada.

VI. CONCLUSIONS

1. DATACOM '76 has made a very valuable addition to our knowledge of the pattern of user expenditure on computer/communications. After careful examination and checking against other available information, its data appear to be generally of good quality and consistency. It more than doubles our direct knowledge of the user sector, and is especially valuable because its coverage is confined to commercial firms. This permits meaningful comparisons of government user and commercial user spending patterns.
2. The DATACOM results cannot be used directly to represent the whole of the commercial sector. The sample was deliberately biased towards large users; if all users spent the same average amount on computer/communications as did DATACOM users, there would have been only about 450 users in Canada in 1975, rather than the 3,000 or so identified in the CIPS Census (to say nothing of the many users without installed computers). And the spending patterns of smaller users clearly diverge from those of larger users.
3. DATACOM's budget data also appears to require adjustment for use with the Secretariat's model because of conceptual differences and reporting errors which probably affect both the figures for in-house equipment and those for other costs. There are indications that the effect on data communications equipment may have been greater than on computer equipment. However, this effect is unlikely to change the fact that user budgets for data communications equipment are substantially greater than budgets for data transmission. The pattern of higher data communications equipment budgets was common for individual firms in every industry group, and nearly universal in the finance and manufacturing groups. Earlier information had tended to suggest that data communications equipment and data transmission costs were about the same size.
4. The DATACOM information appears to require some modifications to the assumptions made in the Secretariat's model and forecast of the growth of computer/communications, but these do not appear to be major. The principal changes appear to be:
 - (i) to discard the assumption that user spending on EDP staff in the commercial sector is a lower proportion of the EDP dollar than in government.

- (ii) to moderate the downtrend in the proportion of user costs directed to in-house equipment, at least for the period 1975-1980. The downtrend in the proportion devoted to computers appears to be roughly offset, at this time, by a rapid build-up of data communications equipment;
- (iii) to moderate the forecast increase in data transmission expenditures;
- (iv) to make some necessary offsetting adjustments in figures for computing services and other costs.

Table 10 presents what are believed to be the best available guides to the distribution of user costs, together with the Secretariat's December 1976 estimates. DATACOM '76 is the basis for three of the guides included in this table. The user sample, reweighted and adjusted, is the average of section 6 of Tables 6 and 7, with the transfer of 1.0 from data communications equipment to "other" to recognize the specific factors mentioned in conclusion 3. The same adjustment has been made to the 27-user chiefly in-house sample, which is otherwise identical with the equivalent unit of Table 4. This edit was not applied to the 6-user chiefly service bureau sample because these users are considered to be more likely to rent or lease such equipment. Footnotes indicate the sort of adjustments that might be made to the Secretariat's 1976 estimates. A revision of these estimates will be made later this year, based on this and some other studies in progress.

Table 1

GROWTH IN COMPUTER/COMMUNICATIONS BUDGETS, BY INDUSTRY GROUP¹
 (45 firms reporting for all years)

Industry Group (no. of firms)	Year	Total Annual Budget	In-House Staff	In-House Equipment				Service Bureaus	Data Trans- mission	Other			
				Total	Data								
					Computer	Comm.	Software						
\$'000													
A: User Industries													
Finance	1975	56,696	20,063	22,666	14,324	8,109	233	2,606	2,286	9,075			
(11)	1976	67,355	24,397	26,113	15,265	10,605	243	3,331	3,080	10,434			
	1977	78,550	26,446	31,227	15,747	15,190	290	5,214	3,749	11,914			
Transportation and Utilities	1975	41,818	15,059	15,718	9,739	5,837	142	510	5,007	5,524			
(4)	1976	48,115	16,325	20,475	13,503	6,900	72	465	4,883	5,967			
	1977	52,696	17,492	23,473	15,775	7,603	95	500	4,768	6,463			
Resource ¹	1975	36,423	16,723	9,746	8,597	980	169	3,515	1,048	5,391			
(4)	1976	41,040	18,808	9,547	8,099	1,229	219	5,283	1,326	6,076			
	1977	45,422	20,588	11,120	9,337	1,493	290	5,400	1,644	6,670			
Wholesale, Retail and Other	1975	34,456	16,756	9,359	8,000	1,148	211	1,807	1,143	5,391			
(8)	1976	42,806	20,707	11,939	10,140	1,495	304	2,111	1,516	6,533			
	1977	50,919	23,595	15,186	12,893	1,882	411	2,701	1,984	7,453			
Manufacturing	1975	51,693	25,846	13,009	10,132	2,697	180	3,661	957	8,220			
(11)	1976	58,158	28,681	14,470	10,940	3,335	195	4,276	1,098	9,633			
	1977	64,864	31,314	17,397	13,042	4,054	301	4,194	1,348	10,611			
Total Users	1975	221,086	94,447	70,498	50,792	18,771	935	12,099	10,441	33,601			
(38)	1976	257,474	108,918	82,544	57,947	23,564	1,033	15,466	11,903	38,643			
	1977	292,451	119,435	98,403	66,794	30,222	1,387	18,009	13,493	43,111			
B: Supplier Industry													
Service Bureaus	1975	44,180	16,841	11,579	9,089	1,617	873	2,757	2,454	10,549			
(7)	1976	50,052	18,376	14,987	12,207	1,640	1,140	3,070	2,968	10,651			
	1977	55,831	20,865	16,785	13,508	2,047	1,230	3,340	2,959	11,882			

1. These groups are as defined for the DATACOM '76 survey and do not match the more detailed Statistics Canada or CIPS classifications. In particular, the Resource group includes some firms classified as Transportation or Utilities in the Standard Industrial Classification, and in the CIPS Census. It is not known whether these firms reported in all years.

Table 2

DISTRIBUTION OF COMPUTER/COMMUNICATIONS BUDGETS, BY INDUSTRY GROUP
(45 firms reporting for all years)

Industry Group (no. of firms)	Year	Total Annual Budget	In-House Equipment						Service Bureaus %	Data Trans- mission %	Other %			
			In-House Staff		Computer		Data Comm.							
			%	%	%	%	%	%						
A: User Industries														
Finance (11)	1975	100.0	35.4	40.0	25.3	14.3	0.4	4.6	4.0	16.0	15.5	15.2		
	1976	100.0	36.2	38.8	22.7	15.7	0.4	4.9	4.6	10.1	12.4	12.3		
	1977	100.0	33.7	39.7	20.0	19.3	0.4	6.6	4.8	9.0	11.9	14.7		
Transportation and Utilities (4)	1975	100.0	36.0	37.6	23.3	14.0	0.3	1.2	12.0	13.2	12.4	12.3		
	1976	100.0	33.9	42.6	28.1	14.3	0.2	1.0	10.1	10.1	12.4	12.3		
	1977	100.0	33.2	44.5	29.9	14.4	0.2	1.0	9.0	9.0	11.9	14.7		
Resource (4)	1975	100.0	45.9	26.8	23.6	2.7	0.5	9.6	2.9	14.8	14.8	14.7		
	1976	100.0	45.8	23.3	19.8	3.0	0.5	12.9	3.2	14.8	14.8	14.7		
	1977	100.0	45.3	24.5	20.6	3.3	0.6	11.9	3.6	11.9	14.7	14.7		
Wholesale, Retail and Other (8)	1975	100.0	48.6	27.2	23.2	3.4	0.6	5.2	3.3	15.7	15.3	14.6		
	1976	100.0	48.4	27.9	23.7	3.5	0.7	4.9	3.5	15.7	15.3	14.6		
	1977	100.0	46.4	29.8	25.3	3.7	0.8	5.3	3.9	15.7	15.3	14.6		
Manufacturing (11)	1975	100.0	50.0	25.2	19.6	5.2	0.4	7.1	1.8	15.9	16.6	16.3		
	1976	100.0	49.3	24.9	18.8	5.7	0.4	7.3	1.9	15.9	16.6	16.3		
	1977	100.0	48.3	26.8	20.1	6.2	0.5	6.5	2.1	15.9	16.6	16.3		
Total Users (38)	1975	100.0	42.7	31.9	23.0	8.5	0.4	5.5	4.7	15.2	15.0	14.7		
	1976	100.0	42.3	32.1	22.5	9.2	0.4	6.0	4.6	15.2	15.0	14.7		
	1977	100.0	40.8	33.7	22.9	10.3	0.5	6.2	4.6	15.2	15.0	14.7		
B: Supplier Industry														
Service Bureaus (7)	1975	100.0	38.1	26.2	20.6	3.6	2.0	6.2	5.6	23.9	21.3	21.3		
	1976	100.0	36.7	30.0	24.4	3.3	2.3	6.1	5.9	21.3	21.3	21.3		
	1977	100.0	37.4	30.0	24.2	3.6	2.2	6.0	5.3	21.3	21.3	21.3		
C: Computer Services														
Revenue \$2 million or more ¹	1974	100.0	40.0	22.3	n.a.	n.a.	0.4	5.3	5.3	27.1	24.9	24.9		
	1975	100.0	40.0	23.0	n.a.	n.a.	1.4	7.5	4.6	27.1	24.9	24.9		

1, Statistics Canada, Computer Services Industry. The figure in the "Service Bureaus" column includes "Purchases of applications development services" (1.4% in 1974, 1.0% in 1975).

Table 3

DISTRIBUTION OF COMPUTER/COMMUNICATIONS BUDGETS, BY INDUSTRY GROUP

(all usable reports)

Industry Group	Year	Total Annual Budget	In-House Staff	In-House Equipment			Data Trans-mission			Data		
				Total	%	Computer	%	Data Comm.	%	Service Bureaus	%	Other
A: User Industries												
Finance	1975	100.0	36.7	38.5	24.4	13.2	0.9	3.4	3.2	18.2		
	1976	100.0	36.8	38.4	23.0	14.7	0.7	3.3	3.2	18.3		
	1977	100.0	33.7	39.7	20.0	19.3	0.4	6.6	4.8	15.2		
Transportation and Utilities	1975	100.0	42.7	36.2	24.5	11.1	0.6	2.2	6.6	12.3		
	1976	100.0	40.5	41.0	28.3	12.2	0.5	1.7	6.2	10.6		
	1977	100.0	33.2	44.5	29.9	14.4	0.2	1.0	9.0	12.3		
Resource	1975	100.0	46.5	29.9	26.5	2.9	0.5	7.6	2.8	13.2		
	1976	100.0	46.4	27.2	23.5	3.1	0.6	10.2	3.0	13.2		
	1977	100.0	45.3	24.5	20.6	3.3	0.6	11.9	3.6	14.7		
Wholesale, Retail and Other	1975	100.0	49.0	27.4	23.5	3.3	0.6	5.0	3.3	15.3		
	1976	100.0	48.9	28.1	24.0	3.4	0.7	4.7	3.5	14.8		
	1977	100.0	46.4	29.8	25.3	3.7	0.8	5.3	3.9	14.6		
Manufacturing	1975	100.0	46.6	22.6	17.3	5.0	0.3	15.1	1.7	14.0		
	1976	100.0	46.7	23.1	17.2	5.6	0.3	13.7	1.8	14.7		
	1977	100.0	48.0	27.1	20.3	6.3	0.5	6.4	2.2	16.3		
Total (54 reports)	1975	100.0	42.3	33.1	23.5	9.0	0.6	5.7	3.8	15.1		
(55 Reports)	1976	100.0	41.7	34.1	23.5	10.0	0.6	5.6	3.7	14.9		
(39 reports)	1977	100.0	40.8	33.7	22.9	10.3	0.5	6.2	4.6	14.7		
B: Supplier Industry												
C: Comparison of 38 User Reports and All User Reports, 1975-77 Average of Percentages												
38 Reports	100.0	41.9	32.6	22.8	9.4	0.4	5.9	4.6	15.0			
All Reports	100.0	41.6	33.7	23.3	9.8	0.6	5.8	4.0	14.9			

B: Identical with firms reporting for all years for 1975 and 1976, and no significant differences for 1977.

C: Identical with firms reporting for all years for 1975 and 1976, and no significant differences for 1977.

Table 4

TYPES OF USER BUDGET REPORTED TO DATACOM '76
 (38 user firms reporting for all years)

Budget Type	Year	Total Annual Budget	In-House Staff	In-House Equipment			Service Bureaus	Data Trans-mission	Other
				Total	Computer \$'000	Comm.			
A. Values Reported by Users									
Full Budget Data -	1975	184,924	84,529	53,679	42,024	10,940	715	9,397	8,589
Chiefly In-House (27 responses)	1976	214,727	97,447	62,361	47,093	14,390	878	12,766	9,563
	1977	242,562	106,570	74,252	53,187	19,865	1,200	14,907	10,783
Full Budget Data -	1975	7,254	3,208	1,033	425	530	78	2,116	324
Chiefly Service Bureau Users ¹ (6 responses)	1976	7,960	3,625	1,093	450	560	83	2,235	333
	1977	8,795	3,933	1,208	497	619	92	2,602	377
Partial Budget Data-1975		28,908	6,710	15,786	8,343	7,301	142	586	1,528
Data Processing ² (5 responses)	1976	34,787	7,846	19,090	10,404	8,614	72	465	2,007
Operations Only ² (5 responses)	1977	41,094	8,932	22,943	13,110	9,738	95	500	2,333
B: Percentage Distributions									
Full Budget Data -	1975	100.0	45.7	29.0	22.7	5.9	0.4	5.1	4.7
Chiefly In-House	1976	100.0	45.4	29.0	21.9	6.7	0.4	5.9	4.5
	1977	100.0	43.9	30.6	21.9	8.2	0.5	6.2	4.4
Full Budget Data -	1975	100.0	44.2	14.2	5.8	7.3	1.1	29.2	4.5
Chiefly Service Bureau Users	1976	100.0	45.5	13.7	5.7	7.0	1.0	28.1	4.2
	1977	100.0	44.7	13.7	5.7	7.0	1.0	29.6	4.3
Partial Budget Data-1975		100.0	23.2	54.6	28.9	25.2	0.5	2.0	5.3
Data Processing	1976	100.0	22.5	54.9	29.9	24.8	0.2	1.3	5.8
Operations Only	1977	100.0	21.7	55.8	31.9	23.7	0.2	1.2	5.7

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- Includes all responses showing greater expenditure on service bureaus than on in-house computer equipment in all three years.
- Includes responses clearly labelled as pertaining to specific parts of corporate computer/communications expenditure, plus all cases where total expenditure on equipment is more than twice expenditure on in-house personnel in all three years, and expenditure on service bureaus is not greater than on in-house computer equipment.

Table 5

GROWTH IN USER COMPUTER/COMMUNICATIONS BUDGETS, BY ADJUSTED INDUSTRY GROUP¹
(33 firms reporting for all years - excludes data processing operations responses)

Industry Group (no. of firms)	Year	Total Annual Budget	In-House Staff	In-House Equipment			Service Bureaus	Data Trans- mission	Other
				Total	Computer	Data \$'000			
Finance (9)	1975	45,448	18,642	15,262	11,422	3,607	233	2,530	1,581
	1976	53,439	22,364	17,701	12,169	5,289	243	3,331	2,087
	1977	61,805	23,836	21,443	12,145	9,008	290	5,214	2,594
Transportation, Utilities and Resource ₁ (5)	1975	60,581	26,493	17,082	12,895	4,018	169	3,515	5,232
	1976	68,284	29,320	19,344	14,294	4,831	219	5,283	5,195
	1977	73,769	31,758	21,434	15,604	5,540	290	5,400	5,234
Wholesale, Retail and Other (8)	1975	34,456	16,756	9,359	8,000	1,148	211	1,807	1,143
	1976	42,806	20,707	11,939	10,140	1,495	304	2,111	1,516
	1977	50,919	23,595	15,186	12,893	1,882	411	2,701	1,984
Manufacturing (11)	1975	51,693	25,846	13,009	10,132	2,697	180	3,661	957
	1976	58,158	28,681	14,470	10,940	3,335	195	4,276	1,098
	1977	64,864	31,314	17,397	13,042	4,054	301	4,194	1,348
Total, User Full Budgets (33)	1975	192,178	87,737	54,712	42,449	11,470	793	11,513	8,913
	1976	222,687	101,072	63,454	47,543	14,950	961	15,001	9,896
	1977	251,357	110,503	75,460	53,684	20,484	1,292	17,509	11,160

1. Groups as defined for the DATACOM '76 survey except for the combination of the survey groups "Transportation and Utilities" and "Resource". This was required both by the small number of returns for these groups after the incomplete data processing operations responses were removed, and to improve comparability with CIPS Census groupings.

23
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29,303

33,264

36,725

Table 6

DISTRIBUTION OF USER COMPUTER/COMMUNICATIONS BUDGETS, BY ADJUSTED INDUSTRY GROUPS¹
(33 firms reporting for all years)

Industry Group (no. of firms)	Year	Total Annual Budget	In-House Staff	In-House Equipment			Service Bureaus	Data Trans- mission	Other			
				Data		Software						
				Total	Comm.							
		%	%	%	%	%	%	%	%			
1. Finance (9)	1975	100.0	41.0-	33.6+	25.1	8.0+	0.5+	5.6-	3.5-			
	1976	100.0	41.9-	33.1+	22.8	9.9+	0.4+	6.2-	3.9-			
	1977	100.0	38.6-	34.7+	19.6	14.6+	0.5+	8.4-	4.2-			
2. Transportation, Utilities and Resource ₁ (5)	1975	100.0	43.7+	28.2+	21.3+	6.6+	0.3+	5.8-	8.7-			
	1976	100.0	43.0+	28.3+	20.9+	7.1+	0.3+	7.7-	7.6-			
	1977	100.0	43.0+	29.1+	21.2+	7.5+	0.4+	7.3-	7.1-			
3. Wholesale, Retail and Other (8)	1975	100.0	48.6+	27.2+	23.2+	3.4+	0.6	5.2-	3.3			
	1976	100.0	48.4+	27.9+	23.7+	3.5+	0.7	4.9-	3.5			
	1977	100.0	46.4+	29.8+	25.3+	3.7+	0.8	5.3-	3.9			
4. Manufacturing (11)	1975	100.0	50.0-	25.2-	19.6-	5.2	0.4-	7.1+	1.8-			
	1976	100.0	49.3-	24.9-	18.8-	5.7	0.4-	7.3+	1.9-			
	1977	100.0	48.3-	26.8-	20.1-	6.2	0.5-	6.5+	2.1-			
5. Total, User Full Budgets (33)	1975	100.0	45.7-	28.5+	22.1+	6.0+	0.4+	6.0	4.6-			
	1976	100.0	45.4-	28.5+	21.4+	6.7+	0.4+	6.7	4.5-			
	1977	100.0	44.0-	30.0+	21.4+	8.1+	0.5+	7.0	4.4-			
6. Total, Reweighted by CIPS Census ₂	1975	100.0	45.9-	28.2	21.8	6.0+	0.4	6.1+	4.5-			
	1976	100.0	45.7-	28.1+	21.0	6.7+	0.4	6.8+	4.3-			
	1977	100.0	44.4+	29.5-	20.9-	8.1-	0.5	7.1+	4.1			

NOTE: Where a "+" or "-" sign follows a percentage, it indicates the direction in which that percentage might appropriately be adjusted on the basis of the relationship between the distribution shown in this table and that in Table 7. In sections 1-5, an adjustment direction is indicated for all three years whenever the same relationship exists between figures for 1975 and 1976 in the two tables (1977 figures are always the same). In section 6, each comparison is independent, but an adjustment direction is shown only when the figures differ by at least 0.5.

1. See note 1, Table 5.
2. See Note and text pp 13-14.

Table 7

DISTRIBUTION OF USER COMPUTER/COMMUNICATIONS BUDGETS, BY ADJUSTED INDUSTRY GROUPS¹
 (all usable reports - excludes data processing operations responses)

Industry Group	Year	Total Annual Budget	In-House Staff	In-House Equipment			Service Bureaus	Data Transmission	Other
				Total	Computer	Data Comm.			
1. Finance	1975	100.0	39.3	35.6	24.2	10.4	1.0	3.7	2.7
	1976	100.0	39.2	36.0	23.0	12.2	0.8	3.6	2.7
	1977	100.0	38.6	34.7	19.6	14.6	0.5	8.4	4.2
2. Transportation Utilities and Resource ₁	1975	100.0	46.0	32.1	24.4	7.2	0.5	4.2	5.4
	1976	100.0	44.8	33.9	25.3	8.0	0.6	5.0	5.2
	1977	100.0	43.0	29.1	21.2	7.5	0.4	7.3	7.1
3. Wholesale, Retail and Other	1975	100.0	49.0	27.4	23.5	3.3	0.6	5.0	3.3
	1976	100.0	48.9	28.1	24.0	3.4	0.7	4.7	3.5
	1977	100.0	46.4	29.8	25.3	3.7	0.8	5.3	3.9
4. Manufacturing	1975	100.0	46.6	22.6	17.3	5.0	0.3	15.1	1.7
	1976	100.0	46.8	22.8	16.8	5.7	0.3	13.8	1.8
	1977	100.0	48.3	26.8	20.1	6.2	0.5	6.5	2.1
5. Total (48 reports)	1975	100.0	44.0	31.1	23.0	7.5	0.6	6.1	3.6
	(48 reports)	100.0	43.6	32.0	22.8	8.6	0.6	6.0	3.5
	(33 reports)	100.0	44.0	30.0	21.4	8.1	0.5	7.0	4.4
6. Total, Reweighted by CIPS Census ₂	1975	100.0	45.2	28.6	21.5	6.5	0.6	8.4	3.1
	1976	100.0	45.0	29.2	21.4	7.3	0.5	8.1	3.1
	1977	100.0	45.6	26.9	20.0	6.5	0.4	8.9	4.1

1. See note 1, Table 5.

2. See text pp. 13-14.

Table 8

USE OF EXTERNAL EDP SERVICES BY SIZE OF USER IN THE FEDERAL GOVERNMENT

Department or Agency (ranked by total cost, 1975-76)	Gross EDP Costs ¹			Net External Services ²			Percent External Services 1976-77 %	
	1975-76	1976-77	1977-78	\$'000	1975-76	1976-77	1977-78	
1. National Defence	31,978	36,159	39,940	2,363	2,486	2,666	7.4	6.9
2. National Revenue - Taxation	25,114	30,366	33,739	236	569	474	0.9	1.9
3. Supply and Services - Services	31,086	29,648	31,280	1,040	829	897	3.3	2.8
4. Environment	17,662	20,658	22,879	3,150	3,464	3,834	17.8	16.8
5. Statistics Canada	17,313	20,317	20,770	1,906	1,560	1,418	11.0	7.7
Subtotal, 1-5	123,153	137,148	148,608	8,695	8,908	9,289	7.1	6.5
6. Unemployment Insurance Comm.	16,970	19,984	22,018	1,366	1,348	1,141	8.0	6.7
7. R.C.M.P.	16,213	17,959	22,579	155	376	257	1.0	2.1
8. Health and Welfare	15,000	16,172	17,648	1,728	1,645	1,994	11.5	10.2
9. Transport	10,346	11,356	16,897	1,898	1,825	2,142	18.3	16.1
10. Energy, Mines and Resources	7,757	8,625	9,451	924	963	1,029	11.9	11.2
Subtotal, 6-10	66,286	74,096	88,593	6,071	6,157	6,563	9.2	8.3
11. Agriculture	7,349	8,296	8,812	1,274	1,255	1,519	17.3	15.1
12. Post Office	8,536	7,520	9,785	1,086	415	237	12.7	5.5
13. Supply and Services - Supply	5,340	7,019	7,464	75	1,309	1,112	1.4	18.6
14. National Revenue - Customs	4,636	6,340	9,018	577	488	912	12.4	7.7
15. Treasury Board Secretariat	4,948	6,252	7,000	819	878	876	16.6	14.0
Subtotal, 11-15	30,809	35,427	42,079	3,831	4,345	4,656	12.4	12.3
16. Manpower and Immigration	4,927	5,605	6,443	2,134	1,961	1,788	43.3	35.0
17. National Research Council	4,660	5,085	5,494	55	218	95	1.2	4.3
18. Communications	4,170	5,013	6,841	1,583	1,904	2,356	38.0	38.0
19. Public Works	3,779	4,982	6,232	2,069	2,786	3,001	54.7	55.9
20. Regional Economic Expansion	3,924	4,497	4,923	1,786	1,781	1,898	45.5	39.6
Subtotal, 16-20	21,460	25,182	29,933	7,627	8,650	9,138	35.5	34.3
25 smaller Depts. and Agencies	20,924	30,283	34,607	6,315	10,659	10,582	30.2	35.2
Total, All Depts. and Agencies	262,632	302,136	343,820	32,539	38,719	40,228	12.4	12.8
								11.7

Source: Treasury Board Secretariat, Review of EDP in the Government of Canada, 1976-77, Tables X, XII.

1. Includes interdepartmental services throughout. Net totals adjusted to remove this duplication appear in Table 9.

2. Includes consultants, systems and programming and training as well as service bureaus. Excludes interdepartmental services.

Non-Government User Sample ³	Total C/C Budget ¹			Service Bureau Budget ²			% Service Bureaus ²		
	1975		1976	1977		1975	1976	1977	
	\$'000			\$'000		%	%	%	
<u>Non-Government User Sample³</u>									
1. Largest - 5th largest	89,246	101,515	113,292	6,609	9,215	11,103	7.4	9.1	9.8
2. 6th-10th largest	39,235	48,679	57,039	1,350	1,750	2,150	3.4	3.6	3.8
3. 11th-15th largest	28,627	33,337	35,930	743	885	720	2.6	2.7	2.0
4. 16th-20th largest	17,807	18,783	21,952	945	1,119	1,327	5.3	6.0	6.0
5. 21st-25th largest	11,833	14,375	16,596	450	647	707	3.8	4.5	4.3
6. 26th-33rd largest	5,430	5,998	6,548	1,416	1,385	1,502	26.1	23.1	22.9
Totals									
7. -33 User sample (T.6)	192,178	222,687	251,357	11,513	15,001	17,509	6.0	6.7	7.0
8. -All User reports (T.7)	337,845	390,683	251,357	20,514	23,381	17,509	6.1	6.0	7.0
<u>Government Users</u>									
9. Federal Government ⁴	244,555	283,292	323,053	32,539	38,719	40,228	13.3	13.7	12.5
10. All governments ⁵	489,110	566,584	646,106	65,078	77,438	80,456			
<u>All Users</u>									
11. C/CS estimates	2,640,000	3,000,000	3,600,000	400,000	450,000	575,000	15	15	16
<u>Other Non-Govt. Users (residual calculation)⁶</u>									
12. Line 11 less 7 and 10	1,959,000	2,211,000	2,703,000	323,000	358,000	477,000	16	16	18
13. Line 11 less 8 and 10	1,813,000	2,043,000	2,703,000	314,000	349,000	477,000	17	17	18

1. Data for Government Users and All Users are costs, not budgets.
2. Data for Government Users and All Users include consultants, systems and programming and training as well as service bureaus.
3. The 33-user sample which excludes the 5 firms who reported only data processing operations budgets to DATACOM '76.
4. Review of EDP in the Government of Canada, 1976-77. Net costs excluding interdepartmental services.
5. Twice line 9. Provincial and municipal spending is about equal to federal costs.
6. Does not take account of reweighting; probably the upper limit of external service use.

	Year	Total Costs %	In-House Staff %	In-House Equipment			Com-puting Services %			Data Trans-mission %			Other Costs %
				Data		Computer %	Comm. %	Software %	Comm. %	Computing Services %	Comm. %	Other Costs %	
				Total %	Computer %	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	
Federal Government Costs ¹	70-71	100.0	49.6	22.0	n.a.	n.a.	n.a.	9.4	0.2	18.8			
	75-76	100.0	45.3	22.1	n.a.	n.a.	n.a.	13.3	2.7	16.6			
	76-77	100.0	45.0	22.0	n.a.	n.a.	n.a.	13.7	3.0	16.3			
	77-78	100.0	44.9	23.3	n.a.	n.a.	n.a.	12.5	3.1	16.2			
All Computer Services Firms ²	1974	100.0	43.8	20.4	n.a.	n.a.	n.a.	6.2	3.9	25.7			
	1975	100.0	44.0	19.9	n.a.	n.a.	1.1	7.6	3.5	25.0			
DATA COM User Sample, Reweighted and Adjusted ³	1975	100.0	45.6	27.4	21.7	5.2	0.5	7.2	3.8	16.0			
	1976	100.0	45.4	27.6	21.2	6.0	0.4	7.4	3.7	15.9			
	1977	100.0	45.0	27.2	20.5	6.3	0.4	8.0	4.1	15.7			
27-Firm Chiefly In-House Sample, Adjusted ⁴	1975	100.0	45.7	28.0	22.7	4.9	0.4	5.1	4.7	16.5			
	1976	100.0	45.4	28.0	21.9	5.7	0.4	5.9	4.5	16.2			
	1977	100.0	43.9	29.6	21.9	7.2	0.5	6.2	4.4	15.9			
6-Firm Chiefly Service Bureau User Sample ⁵	1975	100.0	44.2	14.2	5.8	7.3	1.1	29.2	4.5	7.9			
	1976	100.0	45.5	13.7	5.7	7.0	1.0	28.1	4.2	8.5			
	1977	100.0	44.7	13.7	5.7	7.0	1.0	29.6	4.3	7.7			
Computer/Communications Secretariat Estimates, December, 1976	1970	100.0	46.0 ₆	23.0 ₆	n.a.	n.a.	n.a.	12.0 ₇	2.0	17.0 ₇			
	1975	100.0	44.0 ₆	21.0 ₆	n.a.	n.a.	n.a.	15.0 ₇	4.0	16.0 ₇			
	1976	100.0	44.0 ₆	21.0 ₆	n.a.	n.a.	n.a.	15.0 ₇	4.0 ₇	16.0 ₇			
	1977	100.0	43.0 ₆	20.0 ₆	n.a.	n.a.	n.a.	16.0 ₇	5.0 ₇	16.0 ₇			

1. Treasury Board Secretariat, Review of EDP in the Government of Canada, 1975-76 and 1976-77 issues, Table II.

2. Statistics Canada, Computer Service Industry, 1974 issue, Table 4 and 1975 issue, Table 7.

3. The average of the reweighted figures in Tables 6 and 7 of this paper, with a transfer of 1.0 from Data Communications Equipment to Other Costs (see text p. 18).

4. From Table 4 of this paper, with a transfer of 1.0 from Data Communications Equipment to Other Costs (see text p. 18).

5. From Table 4, without adjustment.

6. The information now available would support the addition of at least 1.0 to these figures.

7. The information now available would support the deduction of about 1.0 from these figures.

DATA COM '76

A SURVEY OF COMPUTER/COMMUNICATIONS

FACTS AND OPINIONS FOR THE

FEDERAL DEPARTMENT OF COMMUNICATIONS

BY

Price
Waterhouse
Associates
management consultants



DEFINITIONS

PART I - FACTUAL INFORMATION

A. CORPORATE INFORMATION

The intent of this section is to provide background data that may be used in correlation analysis, therefore absolute accuracy is not required.

6. Annual data processing budget

The intent of this question is: (a) to establish measures of data processing and data communications expenditures that can be related to other volume and size measures for various classes of organizations, and (b) to establish measures of the relative proportions of costs attributable to mainframe and storage hardware, data communications equipment, transmission facilities, and so forth.

With respect to Question 6, items (a), (b), (c) and (d), the intent is to separate a given data processing organization's operational budget for a year into its component parts. Category (c) may lead to confusion. By way of illustration, therefore, suppose that the total budget is \$20 million. Of this, 25% or \$5 million is for personnel and 15% or \$3 million is for administration, space, etc. The remainder, net of service bureau expenditures, then, is for hardware cost, communication facilities rental, etc. This is the figure we want.

Purchased equipment should be converted to rental equivalent using 1/40th of purchase price.

7. Total telecommunications budget

Because transmission cost is often difficult to establish (because of joint use of facilities, for example), a second, subsidiary set of data are requested, taken from the point of view of the "communications" manager, rather than the "data processing" manager. The intent in both cases is the same, namely, to establish a rough but supportable estimate for communications transmission cost, i.e., payments to carriers, excluding carrier-provided modems, multiplexors, terminals, and other equipment. It is intended that the two estimates of transmission cost represent the same actual dollar figure, arrived at from two separate points of view. This necessitates making judgments about cost allocation for jointly-used lines.

A. CORPORATE INFORMATION (Cont'd.)

		1975	1976	1977
6.	Annual data processing budget (\$000)			
(a)	amount for personnel (\$000)	\$ _____	\$ _____	\$ _____
(b)	amount for administration, supplies, space, etc. (\$000)	\$ _____	\$ _____	\$ _____
(c)	amount for hardware and communication facilities and software rental (or equivalent rental) (\$000)	\$ _____	\$ _____	\$ _____
(d)	amount of service bureau expenditures	\$ _____	\$ _____	\$ _____
	TOTAL ANNUAL BUDGET (\$000)	\$ _____	\$ _____	\$ _____
→ (e)	of hardware and communication cost (i.e., 6(c)):			
(i)	percent mainframe, storage devices, etc.	____%	____%	____%
(ii)	percent data communications equipment (terminals, line controllers, modems, multiplexors/concentrators)	____%	____%	____%
(iii)	percent communications transmission cost only	____%	____%	____%
(iv)	software rental	____%	____%	____%
	NOTE: Above four percentages should total 100%			
7.	Total telecommunications budget (equipment and transmission) (\$000)	\$ _____	\$ _____	\$ _____
(a)	approximate percent for voice, telex, TWX, facsimile, etc.	____%	____%	____%
(b)	approximate percent for data communications	____%	____%	____%
	NOTE: Above two percentages should total 100%			

DRAFT FOR DISCUSSION

REPORT ON SURVEYS - COMPUTER USE AND MIGRATION

(Supplement 2 to the Growth of Computer/Communications in Canada)

Computer/Communications Secretariat
November 1977

FEB 1 1978

Report on Surveys - Computer Use and MigrationI. Introduction

During the latter part of 1976 there were some signs of growing migration of Canadian computing to the United States, and these signs continued and intensified in the early months of 1977. No relevant quantitative information was available, and the Computer/Communications Secretariat therefore undertook the gathering of information about the extent of this migration. Two vehicles were used: a series of six small telephone surveys of known and possible users of computing, and a mail survey (in cooperation with CADAPSO) of Canadian suppliers of computing services.

The telephone surveys of users are described, and the details of results presented, in Appendix A. This technique was chosen partly because of the desire to minimize respondent burdens and partly because of the speed with which some results could be obtained. It limited the surveys to a small number of relatively simple questions, but permitted the results of the first two telephone survey modules to be used to improve the four subsequent modules. In particular, the later modules were extended to determine the extent to which different sources of computing contributed to meeting user demands. A total of 378 usable responses were obtained.

The mail survey (in cooperation with CADAPSO) was intended to determine the awareness of the computing service industry of any migration, and of causes of this migration. Its results appear in Appendix B, as reported to the co-operating firms and to CADAPSO. Thirty-six responses were obtained out of 52 questionnaires sent.

The information yielded by these surveys appears adequate to support a number of general observations about the extent of the use of computing in Canada and of the sources from which it is derived, as well as about the use of foreign-located computers to meet Canadian needs. It also permits an evaluation of the coverage of the CIPS Computer Census, the most general annual guide to computing use. The principal findings are presented in the following sections.

II. The Use of Computing in Canada

1. Most Canadian businesses with revenues of \$5 million or more are already making some use of computing.

(354 of 378 replies, or 94% indicated some use of computing. As the surveys identified only 24 firms with sales below \$5 million, it is necessary to limit this finding to firms with sales of \$5 million or more.)

2. About two-fifths of the businesses that use computing do not have their own computers.

(140 of 354 replies, or 40%. This share remains appropriate even when maximum allowance is made for firms which use only very small computers.)

3. About three-fifths of the businesses that use computing obtain some computing from sources external to the business.

(167 of 283 users who were asked about their use of different sources, or 59%. This was asked only in the last four telephone survey modules.)

4. The sources of external computing distinguished in these surveys, and their frequency of use, are:

Canadian service bureau or unrelated firm	108 users	65%
Canadian parent or affiliate	33 users	20%
Foreign parent or affiliate	31 users	19%
Foreign service bureau or unrelated firm	11 users	7%

(Percentages are of the 167 respondents who were asked about their use of different sources and reported some external sources. The percentages add to 111% because some used more than one class of external source. In this analysis the location of the computer used determines whether a source was classed as "Canadian" or "foreign".)

5. About one-quarter of computing users now obtain services from more than one source (multiple sourcing).

(72 of 283 users who were asked about their use of different sources, or 25%. In this analysis use of an in-house computer and a service bureau, or of two Canadian service bureaus, was counted as multiple sourcing.)

6. Multiple sourcing is more common among users who have their own computers than among those who do not have computers.

(Multiple sources were used by 59 of 175 with their own computers, or 34%, but by only 13 of 108 without their own computers, or 12%.)

III. The Use of Foreign-located Computers

7. More than 10% of Canadian users of computing now make some use of foreign-located computers.

(45 of 354 computer users, or 13%. For those asked about their use of different sources the figures were 40 of 283, or 14%.)

8. The businesses which use foreign computers have larger median sales and staff than those using only Canadian sources.

(Users of foreign computers had median sales of \$32.5 million and median staff of 615. Those using only Canadian sources had median sales of \$22.5 million and staff of 463.)

9. Most users of foreign computing are subsidiaries of foreign firms who use the computers of their parent companies.

(34 of 45 firms who reported use of foreign computing, or 76%, were subsidiaries who reported use of parent company computers.)

10. About half of the users of foreign computers also have a computer located in Canada.

(19 of 40 users of foreign computing who were asked about their use of different sources.)

11. About one-third of those reporting some current use of foreign computing were using foreign sources in 1970.

(14 of 45 responses, or 31%).

12. The rate at which additional firms are commencing use of foreign-located computers has risen steadily over the past six years. From 1974 it appears to have been above the rate at which additional Canadian firms are acquiring Census-size computers (rental value \$1K/month and up).

Year	Survey Results		Estimated Increase, Users with \$1K + Computers in CIPS Census
	No.	% Increase	
1970	14	-	-
1972	18	29%	32%
1974	26	44%	37%
1976	44	69%	53%

13. The businesses which started to use foreign computing in recent years have higher median sales than those which used foreign computing in 1970

Identified Users of Foreign Computing for which 1976 Sales Available

	Number	Median Sales, 1976
Users in 1970	11	\$15.0 million
Added, 1970-74	11	\$28.0 million
Added, 1975-76	13	\$45.5 million

14. The businesses which started to use foreign computing in recent years show a higher average percentage use of foreign computing than those which used foreign computing in 1970.

	<u>Number</u>	<u>Average Foreign Use</u>	<u>100% Foreign Use</u>	
			<u>Number</u>	<u>%</u>
Users in 1970	14	48%	4	29%
Added, 1971-74	12	75%	7	58%
Added, 1975-76	18	82%	11	61%

15. Except in western Canada, most firms in the computing service industry do not regard the emigration of computing from Canada as a major problem at this time. Most seem unaware of any evidence of migration. However most also regard migration as a likely major problem for the future.

IV. Interpretation of the CIPS Computer Census

16. The actual number of computers in Canada large enough for inclusion in the CIPS Computer Census appears to be about 30% above the number recorded in the Census. Up to half of the difference may be picked up in subsequent years, but half or more appears to represent hard core non-response which cannot be identified through existing methods.

(Although 142 of the 214 firms identified as having computers could not be located in the relevant Census, the surveys deliberately over-represented firms not included in the Census. When this is allowed for, the shortfall reduces to about 25% - 35%.)

17. The surveys suggest that IBM computers are underrepresented in the Census by about the following margin:

<u>Rental Class</u>	<u>IBM % of Number of Computers</u>		
	<u>1976 Census</u>	<u>Adjustment</u>	<u>Corrected %</u>
\$10K/month up	60%	+ 4%	64%
\$5 - 9.9K/month	42%	+ 12%	54%
\$1 - 4.9K/month	18%	+ 6%	24%

(This is consistent with information received that IBM is the only major manufacturer which does not help CIPS by identifying its computers missed in the Census.)

18. Almost half of the installations which "disappear" from one CIPS Census to another have likely been deleted in error. To date, however, this has not been a significant source of error in the Census.

(74 of 143 respondents who were "deleted" in the 1974, 1975 and 1976 Censuses reported that they still have in-house computers. It was not determined whether all these firms continued to have computers renting for \$1K/month or more.)

APPENDIX AThe Telephone Surveys - Description and Results

The Computer/Communications Secretariat conducted six small telephone surveys of users or potential users of computer/communications services. The first two surveys were of computer installations in Ontario and B.C. which were listed in the CIPS Computer Census for 1973 or 1974, respectively, and which did not appear in the following Census. Attention was focussed on whether an installation still existed, or whether it had been replaced by services from a source external to the establishment or firm. Telephone calls were directed to the data processing manager, or a senior financial officer of the firm.

The surveys indicated that respondents were quite cooperative, and information additional to that sought was frequently volunteered. A more formal "questionnaire" was drawn up to be filled in by the telephone caller, and this was used in the remaining four surveys (see Table 1). The chief difference in these later surveys was that the use of more than one source of computing was specifically enquired about. Non-response remained a negligible factor.

Two types of problems were encountered in these surveys. One was inability to locate a desired respondent. This happened in some 5% - 20% of the cases, the higher ratios occurring in the first three surveys (of "Disappearances" from the CIPS Census). The second was the inability of some respondents to provide quantitative rather than qualitative estimates, or to provide more than approximations of dates or computer used. In no cases were follow-up calls used to refine the precision of initial approximations.

The six surveys were drawn from three different (but partly overlapping) universes. These universes, and the surveys drawn from each, were as follows:

1. Installations listed in a CIPS Census but not listed in the following year.

1a. All Ontario and B.C. computer installations listed in the 1973 CIPS Computer Census but not listed in the 1974 Census. (34 usable responses.)

- 1b. All Ontario and B.C. computer installations listed in the 1974 CIPS Computer Census but not listed in the 1975 Census. (37 usable responses.)
- 1c. All Ontario and B.C. computer installations listed in the 1975 CIPS Computer Census but not listed in the 1976 Census. This survey was based on a special listing of the 1976 Census file, because of the omission of computers with rentals of \$1 - \$1.9K from the 1976 publication. (77 usable responses.)
- II. Businesses with no installation listed in the CIPS Computer Census.
 2. A sample of important Canadian businesses not listed in the 1975 CIPS Computer Census. This sample was taken from a list developed by another government organization for administrative purposes. Care was taken to ensure that no firms in this or subsequent samples had been contacted in the earlier surveys or in the DATACOM '76 survey. (78 usable responses.)
 3. A sample of Canadian businesses taken from the Canadian Key Business Directory, 1976 (Dun & Bradstreet) but not listed in the 1976 CIPS Computer Census. (75 usable responses.)
- III. Businesses with installations listed in the 1976 CIPS Computer Census.
 4. A sample of Canadian businesses listed in the 1976 CIPS Computer Census and also listed in DUN's (above). (77 usable responses.)

The surveys do not show directly the relative size of these universes, and the samples drawn from each are not proportionate. This requires some caution in drawing conclusions in cases in which the sample results differ appreciably for no obvious reason.

The first three surveys (1a - 1c) were conducted on a (former) computer installation basis; the last three (2 - 4) on a business basis. The difference is that one business can have a number of computer installations in different locations, and it was therefore necessary to adjust the first three surveys to the "business" level for comparability. This difference does not appear to have affected the quality of the information obtained. The "installation" basis had the advantage of including some government agencies which would not be listed ~~as~~ businesses by DUN's, and would otherwise have been omitted entirely. Note that the word "business" as used in the Report includes all respondents, whether from the private or the government sector.

Each usable reply for each survey was checked against DUN's, and the latest sales and number of employees figures obtained. It was not possible to obtain figures for all usable replies in surveys 1a, 1b, 1c and 2, and the matching was especially difficult in the case of the first three surveys. In all samples the distributions of sales and employee figures were extremely skewed (see Table 4), and the median was therefore selected as the best type of average to represent the sample. There appears to be a strong relationship between the median sales and number of employees for any sample and the percentage of respondents with certain characteristics (see Table 5).

The principal results of the surveys are summarized in Tables 2, 3 and 6. Separate results are presented for each survey so that the differences among samples and universes can be appraised. The correlation between firm size and survey results indicated in Table 5 may often make it advisable to use a particular sample to represent a particular group of computer users, rather than simply to use the total of all samples to represent all computer users.

Certain additional data which are not summarized in the tables may also be of some interpretative value. A check of 350 DUN's entries (3% of the total) showed that only 312 (89.1%) had an associated sales figure, although all had an employee figure. The median sales of these 312 firms was \$6.9 million. A check of 606 firms listed by CIPS (22% of the total) showed that only 338 (55.8%) were also listed in DUN's, and 294 of these (87.0%) showed a sales value. The median sales of these 294 firms was \$20.0 million. Government sector (non-business)

installations accounted for 81 of the 268 cases (30.2%) in which CIPS entries could not be matched to DUN's. Both the DUN's check and the CIPS check contained two sub-samples, and in both cases the sub-samples were quite consistent with each other.

The surveys provide some basis for estimating the number of users of computing in Canada with sales of \$1 million or more, plus government agencies and most users of minicomputers. A very preliminary estimate of this universe is as follows:

Users with computers valued

at \$1K/month or more	- in CIPS (76)	2,800			
	- in DUN's but not in CIPS (76)	1,600	4,000	31%	

Users having only computers

valued at less than

\$1K/month	- in DUN's	1,400			
	- not in DUN's	2,600	4,000	28%	

Users without computers	- in DUN's	4,550			
	- not in DUN's	1,350	<u>5,900</u>	<u>41%</u>	
Total users			14,300	100%	

The samples contribute to all parts of this estimate. The figure for users with only very small computers, not in DUN's (2,600) is currently viewed as an "upper level" estimate, subject to further analysis. The estimate for users without computers not in DUN's (1,350) does not include any allowance for users with sales below \$1 million; no data on such small users were available from the surveys.

Table 1. Questionnaire Used to Guide Telephone Surveys 1c-4

The caller gave a brief explanation of the survey, which related to the universe from which the sample was drawn. The common elements of all explanations were that the survey was concerned with the use of computing by Canadian firms, and that the firm being called was either omitted from or included in the CIPS Computer Census. The following questions were then asked.

1. Does your firm (still) make use of computers?	Yes	No
-----	<input type="checkbox"/>	<input type="checkbox"/>

2. Does your firm (still) have computer(s) located in Canada?	<input type="checkbox"/>	<input type="checkbox"/>
---	--------------------------	--------------------------

If "yes", please give location and type of your largest computer now installed in Canada.

3. Does your firm obtain computing services from:	<input type="checkbox"/>	<input type="checkbox"/>
---	--------------------------	--------------------------

a) A service bureau or the facilities of another organization on a fee-for-use basis?

If so, please state where the service source is located.

b) The facilities of a parent or affiliate company?	<input type="checkbox"/>	<input type="checkbox"/>
---	--------------------------	--------------------------

If so, where are the computing facilities of this company located?

IN RESPONSE TO QUESTIONS 3 a) OR b), IF ANY COMPUTING IS CARRIED OUT OUTSIDE CANADA

4. Has your firm always had some of its computing done outside Canada?	<input type="checkbox"/>	<input type="checkbox"/>
--	--------------------------	--------------------------

If no, please specify:

a) The year that it started to use "outside Canada" sources?

b) Why it started to use "outside Canada" sources?

c) About what percentage of your computing is done by "outside Canada" sources?

Table 2

Basic Responses to Telephone Surveys

* Includes computing purchased from any unaffiliated company.

* "Always" defined as "1970 or earlier".

Table 3 Single and Multiple Facility Computer Use Reported

Single and Multiple Facility Computer Use Reported

		Firms With Computers				Firms Without Computers				Total All Firms	
		1c	2	3	4	Total	1c	2	3	4	Total
Total Users of Computing		35	46	22	72	175	37	29	37	5	108
Use Own Computer Only		27	21	16	52	116	-	-	-	-	283
Single External Facility Used											
1 Canadian service bureau		4	9	5	11	29	17	14	25	0	56
1 Canadian parent, affiliate		1	1	0	1	3	10	5	4	4	23
1 Foreign parent, affiliate		2	6	1	2	11	7	3	4	0	14
1 Foreign service bureau		0	4	0	1	5	1	1	0	0	2
More than One Service Bureau											
All Canadian		1	1	0	2	4	0	3	2	0	5
Canadian and Foreign		0	0	0	1	1	0	1	0	0	1
Affiliate and Service Bureau											
All Canadian		0	3	0	1	4	1	1	1	0	3
Foreign affiliate, Canadian service bureau		0	1	0	1	2	1	0	1	0	2
Foreign affiliate, Canadian & Foreign Service Bureau		0	0	0	0	0	0	1	0	0	1
All Foreign		0	0	0	0	0	0	0	0	1	1
Total Users of Multiple Facilities		8	25	6	20	59	2	6	4	1	13
Total Users of Foreign Facilities		2	11	1	5	19	9	6	5	1	21

Table 4

Distribution of Available Sales and Number of Employees of Computing Users Included in Surveys, and Medians for Individual Samples

Class Interval, Sales ('000,000) or Sample Number	All Users	Canadian Facilities		Foreign Facilities		Class Interval, Employees (No.) or Sample Number	All Users	Canadian Facilities		Foreign Facilities
		No. of Firms	Only	No. of Firms	Only			No. of Firms	Only	
\$ 1-\$ 4.9	22	18	4	4	1	99	15	14	1	
\$ 5-\$ 9.9	52	48	4	7	100-	199	61	57	4	
\$ 10-\$ 19.9	55	48	7		200-	299	35	31	4	
\$ 20-\$ 29.9	25	23	2		300-	399	22	18	4	
\$ 30-\$ 39.9	25	22	3		400-	499	14	11	3	
\$ 40-\$ 49.9	17	13	4		500-	599	12	10	2	
\$ 50-\$ 69.9	16	14	2		600-	699	17	15	2	
\$ 70-\$ 99.9	18	14	4		700-	799	11	9	2	
\$100-\$149.9	16	14	2		800-	899	9	9	0	
\$150-\$199.9	15	13	2		900-	999	13	11	2	
\$200-\$299.9	11	10	1		1,000-4,999	73	59	14	14	
\$300 and up	8	7	1		5,000 and up	13	13	13	0	
Total available	280	244	36		Total available	295	257	257	38	
				\$'000,000				No. of Employees		
Ma (arithmetic mean)	67.6	69.3	56.1		Ma (arithmetic mean)	1,104	1,118	1,118	1,007	
Ma (5 highest, 1 lowest values removed)	50.6	49.8	39.4		Ma (5 highest, 1 lowest values removed)	922	909	909	800	
Md (median)	22.5	22.5	32.5		Md (median)	512	463	463	615	
Sample Medians					Sample Medians					
Sample 1a	22.4	-	-		Sample 1a	645	-	-	-	
1b	35.6	-	-		1b	850	-	-	-	
1c	15.0	21.2	13.0		1c	300	300	300	200	
2	51.2	50.6	60.0		2	1,000	950	950	1,000	
3	10.0	10.0	10.8		3	200	190	190	738	
4	29.0	29.0	42.5		4	400	350	350	545	

Table 5

Apparent Relationships Between Median Size of Firms in Sample and Responses Received

		2	1b	4	1a	1c	3
Median Sales of Users	\$M	51.2	35.6	29.0	22.4	15.0	10.0
Median Employees of Users	\$M	1,000	850	400	645	300	200
% of Users of Computing	%	96.2	100.0	100.0*	100.0	93.5	78.6
% of Users with Computers	%	61.3	64.9	93.5*	44.1	48.6	37.3
% Using Multiple Sources	%	41.3	n.a.	27.3	n.a.	13.9	16.9
% Using Canadian Service Bureau	%	45.3	n.a.	20.8	n.a.	33.3	57.6

* A high percentage here is almost required by the nature of this sample.

Table 6

Year in Which Reported Foreign Computer Use Began, and Average Foreign Use and Median Sales of Users

	1970*	1971	1972	1973	Number	1974	1975	1976
1a	0	0	0	0		3 [@]	X	X
1b	0	0	0	0		0	2 [@]	X
1c	3	0	0	0		1	2	5
Total, 1a-1c	3	0	0	0		4	4	5
2	8	0	2	1		1	2	3
3**	2	0	2	0		0	0	1
4	1	0	0	0		2	3	0
Total, 2-4	11	0	4	1		3	5	4
Total, all surveys	14	0	4	1		7	9	9
Average % of computing obtained from foreign sources	48.1			74.7			82.2	
Median current sales \$M	15.0			28.0			45.5	
No. of firms for which sales available	11			11			13	

* Or earlier.

@ Some of these may have started in the previous year.

X No entry possible.

** One 1977 start reported in this survey. Two firms in 1c reported definite plans to switch to foreign sources in 1977.

APPENDIX BResults of CADAPSO Survey as Supplied to CADAPSO
and Participating Firms

Enclosed are the results of the survey of CADAPSO members regarding the emigration of computing service activities from Canada in which you participated.

In tabulating the responses, we looked for variations according to the annual revenue of the firms responding (where available from public sources) and also according to the principal activities in which the respondents are engaged. Neither factor seems to have had a significant influence on response patterns. However, it does appear that respondents in western Canada are more aware of losses of customers and prospects to foreign competitors, and of moves of in-house operations abroad, and are consequently more inclined to regard emigration as already a major problem, than are firms in Ontario and Quebec (there were no responses from the Atlantic Provinces). It might however be pointed out that the President of one Ontario firm, who had earlier indicated little concern about this problem, said in his response that "I was surprised that there is as much movement to the U.S."

Seventeen respondents mentioned specific cases of emigration in response to questions 2, 3 and 4, and identified 16 different former customers, 15 different prospects and 13 moves of in-house activities (a total of 44 user firms). A further 19 cases of Canadian subsidiaries believed to use U.S. parent company facilities and 6 cases of Canadian firms believed to use U.S. service facilities were also identified.

Only 7 of the 36 respondents indicated that they are now marketing their services outside Canada. About the same number indicated that they were considering the export market, either from a Canadian centre or a foreign centre.

Also enclosed, for comparison, is a summary table containing some results of a telephone survey of Canadian firms and organizations which was taken by the Computer/Communications Secretariat this spring and summer. There is relatively little overlap between the users of foreign facilities mentioned by CADAPSO survey respondents and those identified in the C/CS survey. Further results of the C/CS survey can be made available at a later date - please let us know if you are interested.

Yours sincerely,

Peter Robinson
Acting Chairman

Encls.

Question	Number of responses		Percent of definite responses		
	Yes	No	uncertain or no response	Yes	No
1. Do you regard the emigration of computing service activities from Canada as a major problem: (a) now? (b) for the future?	7 25	26 5	3 6	21 83	79 17
2. Have any of your <u>customers</u> switched from using your services to using services <u>from U.S.</u> or other foreign sources?	11	22	3	33	67
3. Have any of your <u>prospects</u> decided in favour of using services from U.S. or other foreign sources?	8	25	3	24	76
4. Are you aware of any other firms who have moved or are about to move their <u>in-house EDP activities to the U.S.</u> or another foreign country?	7	25	4	22	78
5. Are you contemplating, or have you already established foreign-based computing activities to serve the Canadian market?	8	25	3	24	76
6. (See next page.)					
7. Have your sales in the U.S. or other foreign countries been increasing sufficiently to offset any loss of business noted above?	3	4	29	—	—

Total questionnaires sent: 52

Total responses received : 36 (plus one letter explaining that questionnaire not relevant to that firm's business).

Response rate : 69%

6. Could you itemize reasons for any of the moves you have identified in the earlier questions?

A total of 26 responses mentioned, directly or indirectly, at least one reason why Canadian firms use U.S. computing, or why Canadian service suppliers are considering U.S. locations. Many mentioned a number of reasons. The reasons mentioned are listed below in order of frequency of mention.

(i) <u>Cost factors</u>	12 responses
(a) lower hardware cost (especially from duty and sales tax)	7 responses
(b) lower operating costs in general	5 responses
(c) lower labour costs	5 responses
(d) higher labour productivity	2 responses
(e) lower communications costs	2 responses
(ii) <u>Subsidiaries</u> who are required to use parent company sources.	9 responses
(iii) Availability of <u>specialized software</u> or <u>data bases</u> .	7 responses
(iv) <u>Service bureaus</u> who switch to U.S. suppliers and take customers with them.	4 responses
(v) Lack of <u>customs protection</u> .	4 responses
(a) <u>free entry of data processing</u> performed abroad, or nominal duty on printed matter	2 responses
(b) dumping of excess capacity by U.S. firms	2 responses
(vi) Miscellaneous	5 responses
(a) Canadian customer felt continuity of supply more likely	1 response
(b) customers who moved after Canadian supplier eliminated by banks, insurance companies	1 response
(c) use of U.S. source at high prices to permit invisible profit transfer	1 response
(d) data security	1 response
(e) superior marketing strength of U.S. firms	1 response

Single and Multiple Facility Computer Use Reported in C/CS Telephone Survey

	Number of Firms			% of Firms		
	With own Computer	No Computer	Total	With own Computer	No Computer	Total
Total users of computing	175	108	283	100	100	100
Use in-house computer only	116	-	116	66	-	41
Use single external facility						
Canadian service bureau	48	95	143	28	88	50
Canadian parent, affiliate	29	56	85	17	52	30
Foreign parent, affiliate	3	23	26	2	21	9
Foreign service bureau	11	14	25	6	13	9
	5	2	7	3	2	2
Use more than one service bureau						
All Canadian	5	6	11	3	6	4
Canadian and foreign	4	5	9	2	5	3
Use affiliate and service bureau facilities						
All Canadian	6	7	13	3	6	5
Foreign affiliate, Canadian service bureau	4	3	7	2	2	3
Foreign affiliate, Canadian and foreign service bureaus	2	2	4	1	2	1
All foreign	0	1	1	0	1	1
Total users of multiple facilities	59	13	72	34	12	25
Total users of foreign facilities	19	21	40	11	19	14

Notes: 1. The term "service bureau" includes any unaffiliated supplier of computing services.

2. The term "Canadian" means that the equipment or personnel supplying the service were located in Canada.

3. All percentages rounded to add.

3 1761 11551164 4

